November, 1948

EDISON ELECTRIC INSTITUTE BULLETIN

LIBRARY DEC 1948

		Page
Electric Power Supply and Load in the U. S.	C. W. MAYOTT	357
EEI General, Engineering and Accounting Committees Organized to Meet Wide Demands of Industry's Activities		363
The Utilities Part in the Mobile Radio Hearings		373
Electrical Testing Features Involved in Starting the New O. H. Hutchings Generating Station of the Dayton Power & Light Company	H. E. DEARDORFF	379
Elimination of Gaskets on Underground Submersible Transformers	C. P. XENIS	383
Information On Seven Major Prize Competitions		385
Report of the Meeting of ACRMA-EEI-NEMA-REMA Joint Committee on Air Conditioning and Refrigerating Equipment	J. W. ANDERSON	387
Transmission and Distribution Committee Meeting	T. J. BROSNAN	388
Electrical Equipment Committee Meeting	B. VAN NESS, JR.	389
Personals		391
Conventions and Meetings		392

PUBLISHED MONTHLY BY EDISON ELECTRIC INSTITUTE

ELECTRICAL RESEARCH STATISTICS
THE ELECTRIC LIGHT AND POWER INDUSTRY

Current Statistical Data Covering 100 Per Cent of Industry

August, 1947-1948

SOURCE AND DISPOSAL OF ENERGY—MONTH OF AUGUST

	1948	1947	%
GENERATION* (Net)			
By Fuel Burning Plants	17,493,894,000	15,690,377,000	+11.5
By Water Power Plants	6,734,816,000	6,053,377,000	+11.3
Total Generation	**24,228,710,000**	**21,743,754,000**	**+11.4**
Add—Net Imports Over International Boundaries	92,000,000	123,800,000	−25.7
Less—Company Use	118,576,000	126,932,000	− 6.6
Less—Energy Used by Producer	500,377,000	449,077,000	+11.4
Net Energy for Distribution	**23,701,757,000**	**21,291,545,000**	**+11.3**
Losses and Unaccounted for	3,521,272,000	3,192,422,000	+10.3
Sales to Ultimate Customers	**20,180,485,000**	**18,099,123,000**	**+11.5**

CLASSIFICATION OF SALES

NUMBER OF CUSTOMERS—As of August 31st			
Residential or Domestic	32,853,172	30,959,955	+ 6.1
Rural (Distinct Rural Rates)	1,649,032	1,458,331	+13.1
Commercial or Industrial:			
Small Light and Power	5,098,690	4,889,790	+ 4.3
Large Light and Power	204,712	187,878	+ 9.0
Other Customers	138,216	130,413	+ 6.0
Total Ultimate Customers	**39,943,822**	**37,626,367**	**+ 6.2**
KILOWATTHOUR SALES—During Month of August			
Residential or Domestic	3,823,584,000	3,331,678,000	+14.8
Rural (Distinct Rural Rates)	731,953,000	680,635,000	+ 7.5
Commercial or Industrial:			
Small Light and Power	3,728,494,000	3,252,197,000	+14.6
Large Light and Power	10,648,263,000	9,600,953,000	+10.9
Street and Highway Lighting	188,685,000	174,538,000	+ 8.1
Other Public Authorities	502,412,000	483,419,000	+ 3.9
Railways and Railroads:			
Street and Interurban Railways	305,180,000	324,321,000	− 5.9
Electrified Steam Railroads	199,440,000	207,622,000	− 3.9
Interdepartmental	52,474,000	43,760,000	+19.9
Total to Ultimate Customers	**20,180,485,000**	**18,099,123,000**	**+11.5**
Revenue from Ultimate Customers	**$356,618,700**	**$315,590,400**	**+13.0**

RESIDENTIAL OR DOMESTIC SERVICE

AVERAGE CUSTOMER DATA—For 12 months ended August 31st			
Kilowatthours per Customer	1,521	1,400	+ 8.6
Average Annual Bill	$46.09	$43.68	+ 5.5
Revenue per Kilowatthour	3.03¢	3.12¢	− 2.9

(*) By courtesy of the Federal Power Commission.

Vol. 16, No. 11, EDISON ELECTRIC INSTITUTE BULLETIN; published monthly. Entered as second-class matter Aug. 17, 1933, at the post office at Philadelphia, Pa., under the act of March 3, 1879. Publication office, 56th and Chestnut Sts., Philadelphia 39, Pa. Editorial office, 420 Lexington Ave., New York 17, N. Y. Subscription rate $2.00 per year in the United States; $3.00 per year in foreign countries.

The Edison Electric Institute does not assume responsibility for, nor necessarily endorse or approve, statements made by contributors to the BULLETIN.

EDISON ELECTRIC INSTITUTE BULLETIN

Volume 16 NOVEMBER, 1948 No. 11

Electric Power Supply and Load in the United States

By C. W. Mayott

Assistant to the President, The Hartford Electric Light Co.

An address before the Naval Reserve Officers Supply Corps, New York, N. Y., Oct. 14, 1948.

THE Edison Electric Institute decided two years ago that the unprecedented load increase made it advisable to keep even more detailed current information than had heretofore been kept by them on this subject. By a vote of the Board of Directors of EEI, a special committee of four was appointed. The members of this committee had held the key positions in the Office of War Utilities of the War Production Board during World War II.

Power Peaks

For the last two years this committee has maintained up-to-date information as to loads, capacities, new equipment scheduled, manufacturing situations and other pertinent information. To obtain this information, the committee has held semi-annual conferences at Edison Electric Institute headquarters with the key operating men from private electric power companies from each section of the United States.

From 1930 to 1934, the peak load of the electric power industry practically remained constant. During that period, the installed capacity reached a point 17,000,000 kw above the load of approximately 20,000,000 kw. Whole steam stations were shut down with only a skeleton crew. At the beginning of the war in Europe, the capacity was still some 10,000,000 kw above the load which had grown to over 30,000,000 kw. Therefore, we entered the war with a very material margin of capacity. There was also a corresponding margin in manpower and materials.

In October 1941, the Power Branch of the Office of Production Management (later WPB) made the following estimates after an exhaustive study.

	Power Branch Estimate	Actual Peak
	In Milions of Kw.	
1941	32	31.7
1942	35.6	33.1
1943	37.5	37.4

After the declaration of war, one of the first duties of the Power Division of the Office of War Utilities was to carefully re-estimate the power needs of the country and pare down the installation of new electric power equipment to just barely meet the demand for the latter part of the war.

In 1942 the Federal bureaus gave estimates as high as 10,000,000 kw above those of the War Production Board and claimed that the WPB was over-estimating the capacity by 1,200,000 kw. Dire results were predicted if the installation of those additional amounts of new electric power equipment was not added to electric power capacity. Such an error in decision would have had extremely detrimental effects on the over-all war effort. The extra material for such an expanded program could only have come out of the Navy's requirements. The detailed description of this controversy, appears in the recently completed history of the Office of War Utilities.

"A major achievement of the utilities of this country is the fact that curtailment provisions of Order L-94 never had to be used (in World War II). *The one industry which was most frequently singled out, before the war, as the weak link in America's ability to produce munitions stands today as the one industry which, through the war, met every requirement placed upon it.*"

—Excerpt from the "History of the Office of War Utilities"

Rate of Growth of Load

Fig. 1 shows the monthly kwhr sales for the domestic load, commercial load, and industrial load for the United States. It shows the rate of growth of each of these loads over the period 1929-1948 inclusive. You will note that the industrial load, which is an index of industrial production, held practically constant from December 1943 until the end of the war. During that period, we reached a ceiling in our production which we were unable to push through. You will note also that through all this period, the domestic and commercial use increased at a very material rate.

However, all load was carried and as Secretary of the Interior J. A. Krug (then in charge of the War Production Board) has stated, "Power Was Never Too Little Or Too Late." Another pertinent comment is found in the "History of the Office of War Utilities," which

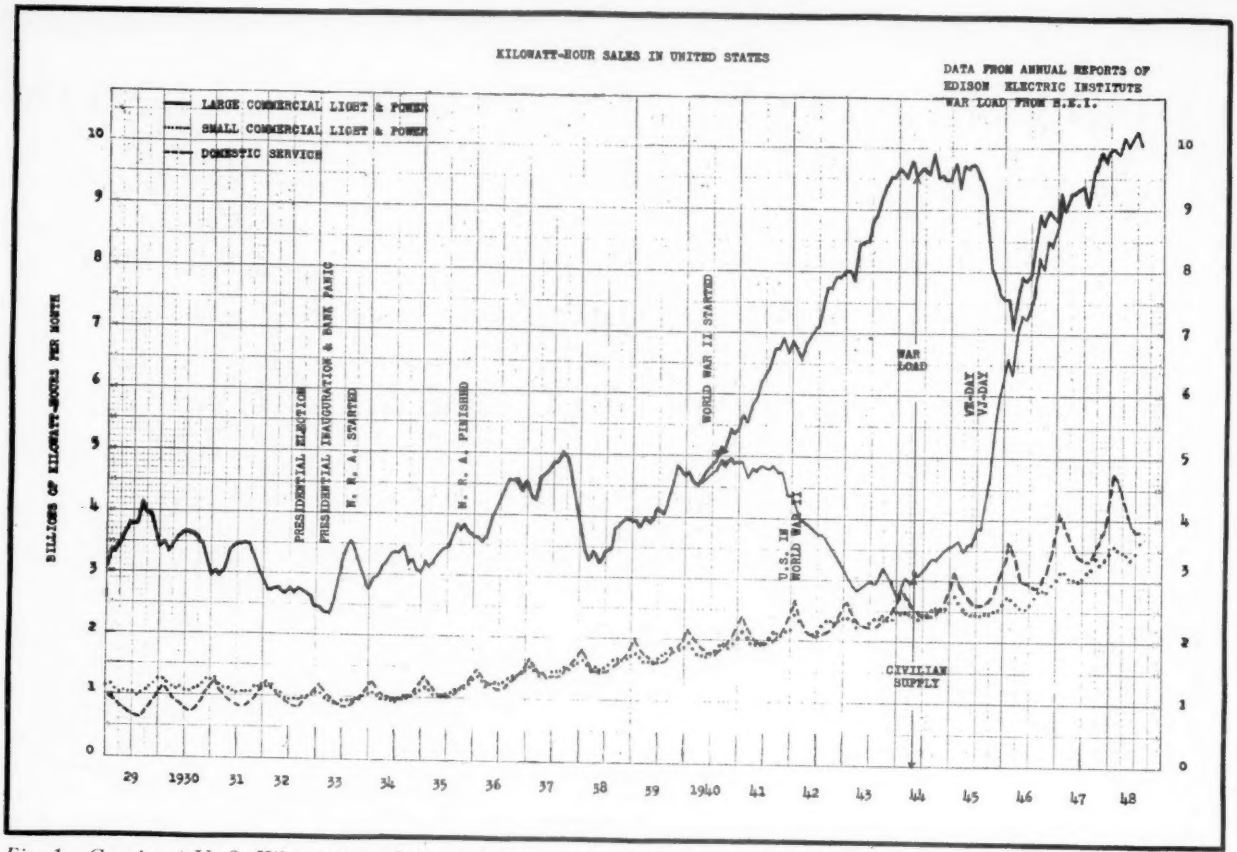

KILOWATT-HOUR SALES IN UNITED STATES
DATA FROM ANNUAL REPORTS OF EDISON ELECTRIC INSTITUTE
WAR LOAD FROM E.E.I.
LARGE COMMERCIAL LIGHT & POWER
SMALL COMMERCIAL LIGHT & POWER
DOMESTIC SERVICE
BILLIONS OF KILOWATT-HOURS PER MONTH
PRESIDENTIAL ELECTION
PRESIDENTIAL INAUGURATION & BANK PANIC
N. R. A. STARTED
N. R. A. FINISHED
WORLD WAR II STARTED
U.S. IN WORLD WAR II
WAR LOAD
VE-DAY
VJ-DAY
CIVILIAN SUPPLY
29 1930 31 32 33 34 35 36 37 38 39 1940 41 42 43 44 45 46 47 48

Fig. 1—Graphs of U. S. Kilowatthour Sales to Large and Small Commercial Light and Power and Domestic Service from 1929 to 1948

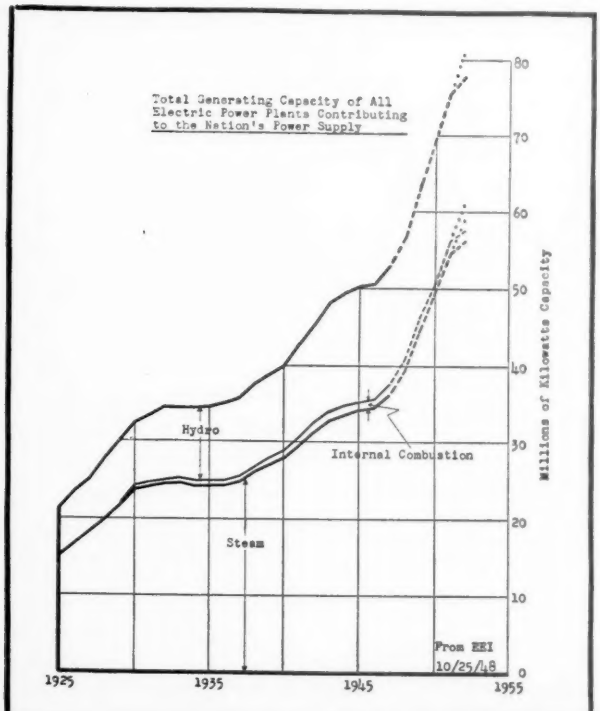

Total Generating Capacity of All Electric Power Plants Contributing to the Nation's Power Supply
Millions of Kilowatts Capacity
Hydro
Internal Combustion
Steam
From EEI 10/25/48
1925 1935 1945 1955

Fig. 2—Total Generating Capacity of All Electric Power Plants Contributing to Nation's Power Supply, 1925-48

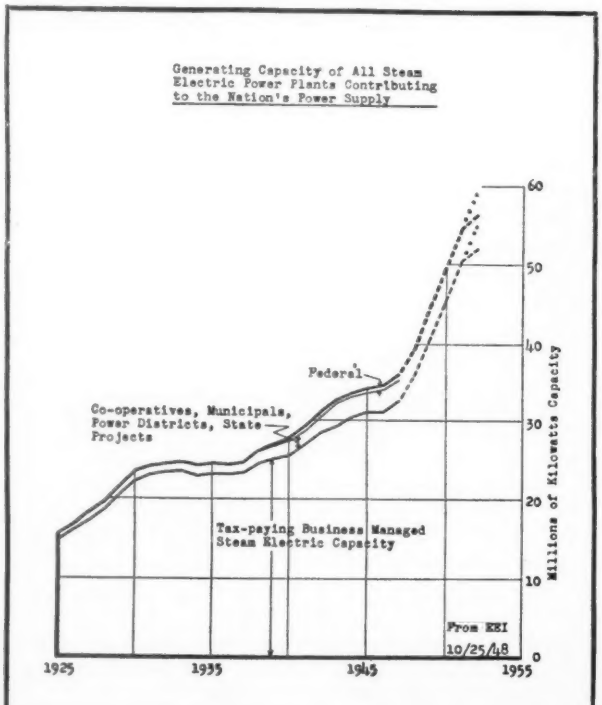

Generating Capacity of All Steam Electric Power Plants Contributing to the Nation's Power Supply
Millions of Kilowatts Capacity
Federal
Co-operatives, Municipals, Power Districts, State Projects
Tax-paying Business Managed Steam Electric Capacity
From EEI 10/25/48
1925 1935 1945 1955

Fig. 3—Generating Capacity of All Steam-Electric Power Plants Contributing to the Nation's Power Supply

notes that "A major achievement of the utilities of this country is the fact that curtailment provisions of Order L-94 never had to be used. The one industry which was most frequently singled out, before the war, as the weak link in America's ability to produce munitions stands today as the one industry which, through the war, met every requirement placed upon it."

After the war ended, we had a drop in production but as shown on the chart, this was of short duration and we have now climbed to a place somewhat above the peak for war production. Our domestic use is now twice that of the pre-war maximum.

As soon as war conditions warranted the power industry was given approval to start building up its reserves again and the orders for electric power equipment poured into the manufacturers. At the present time the best possible delivery date for large turbines and boilers is the latter part of 1951.

Scheduled New Equipment
1948 to 1952 inclusive
Millions of K. W.

	Steam	Hydro	Total
Utilities	20.3	1.1	21.3
Governmental bodies	1.1	3.6	4.7
Totals	21.4	4.7	26.0
Probable increase if future conditions warrant			3.0
			29.0

Plans for the last two years of this period are still incomplete.

Hydro Versus Steam

Fig. 2 shows the yearly installed capacity in hydro and steam. You will note that the main dependence for power in this country has been from fuel generation and it will continue to be so. The vast increase in new capacity is for this type of equipment.

Fig. 3 shows the installed steam capacity divided between private utilities and those owned by governmental bodies.

Fig. 4 gives the hydro picture. The graph line at the bottom shows the capacity of hydro power owned by the private companies. Between the lower and the top line is the government installation.

The hydro picture has been greatly distorted to the public by the desire of certain groups to use its development as a means of socialization. Federal regulation has prevented any appreciable hydro development by private industry for the last sixteen years. Hydro power is not a cheap source of power as against fuel generation when all the costs are

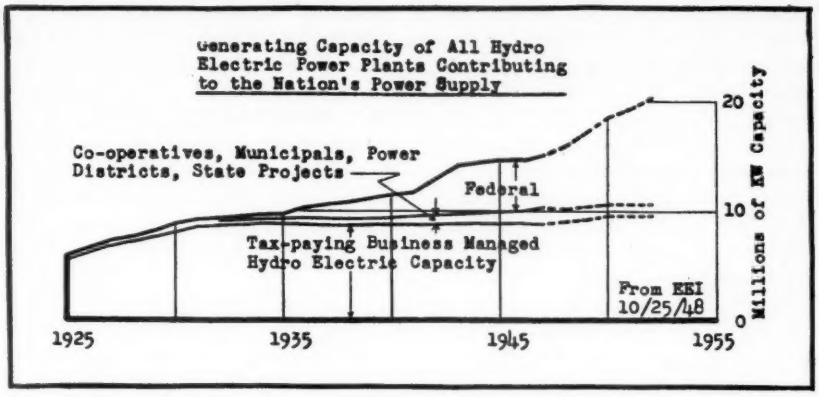


Fig. 4—Generating Capacity of All Hydroelectric Power Plants Contributing to the Nation's Power Supply, 1925-48

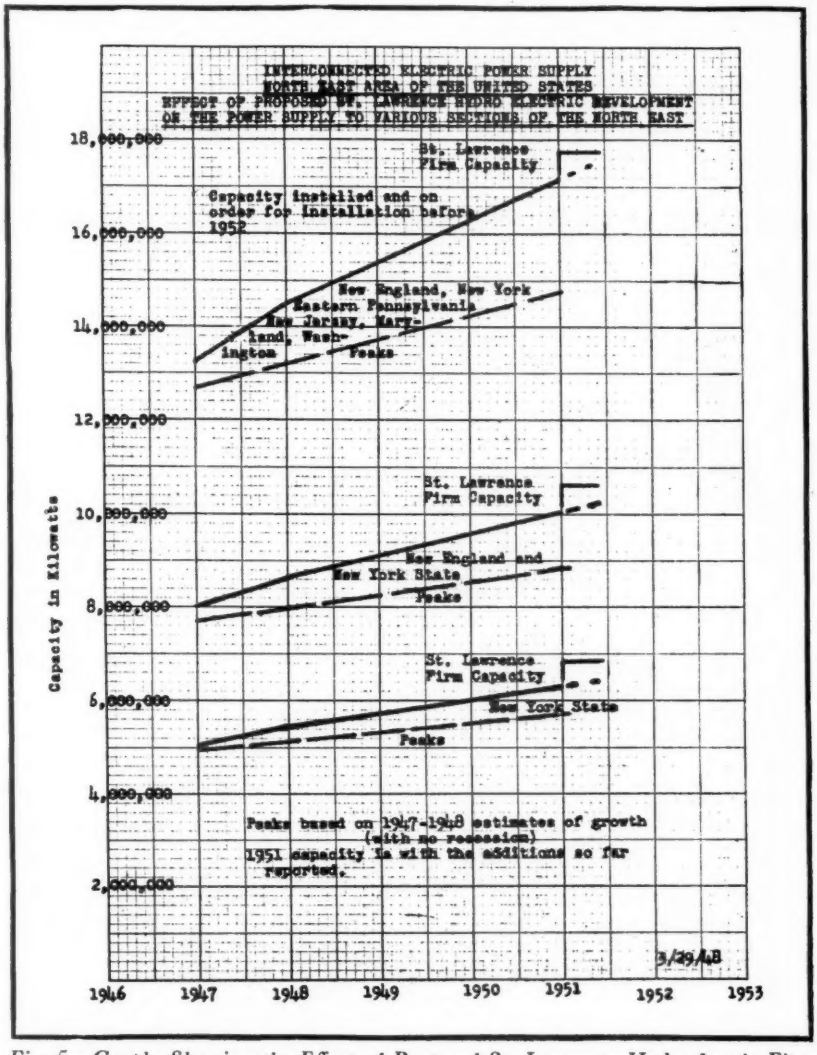


Fig. 5—Graphs Showing the Effect of Proposed St. Lawrence Hydroelectric Firm Capacity on the Power Supply to Various Sections of Northeastern U. S.

correctly allocated. This is particularly true of the remaining sites. This should not be considered as an argument by me against any hydro developments or against the maximum use of our natural resources. However, it is a statement of facts well substantiated. The cost of some of the hydro projects are running up to $1000 per kw or more, while the cost of constructing steam plants is now from $150 to $200 per kw.

Many of the undeveloped hydro sites have relatively small amounts of water available during dry periods. The proposed installed capacity of many of these is way above the stream flow available except during high water periods. This is also true of many of the present installations. There are some, where the stream flow gets so low that one-half hour at full load uses up the stream flow for the week.

Just at present, the St. Lawrence development is in the forefront. This proposed development is fairly large. The stream flow is fairly constant although the maximum flow is almost twice the minimum flow. While its size might seem large, it will be a relatively minor factor in the power situation for the Northeast. There are four steam plants within New York State that have a capacity equal to the 570,000 kw firm capacity on the New York side of the St. Lawrence.

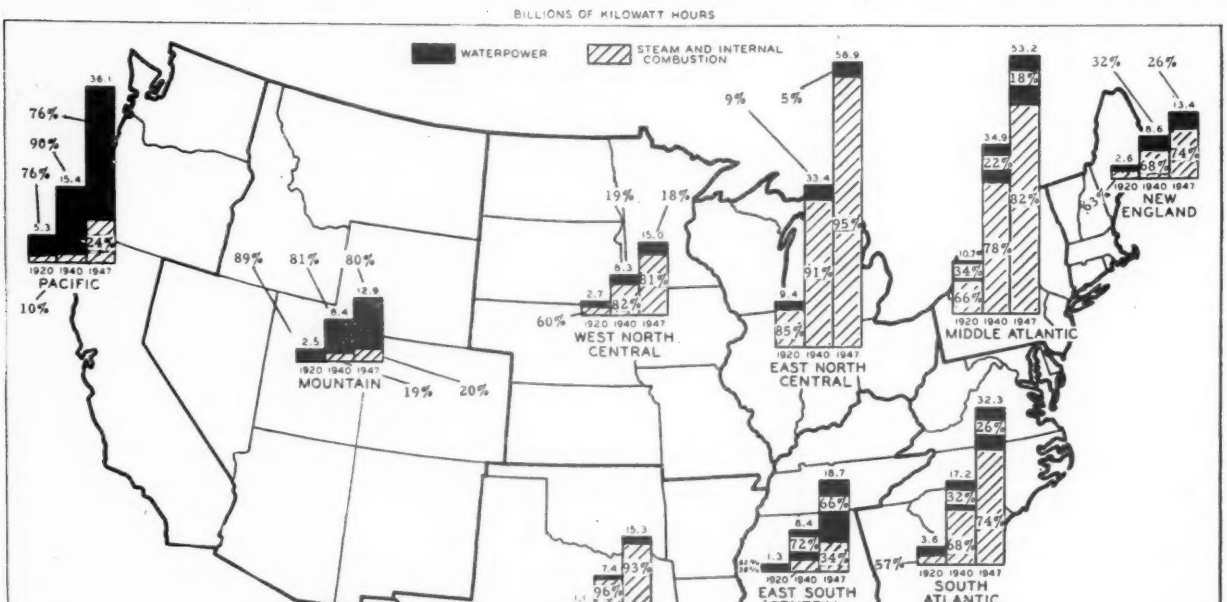
St. Lawrence Project Capacity

Fig. 5 shows the relative size of the firm capacity for the New York side of the St. Lawrence as against the installed capacity in New York State, in New England and New York State, and for the interconnected systems of the Northeast. At the present time, the private power companies in the State of New York have over 1,000,000 kw of steam capacity scheduled for installation through 1948 to 1951 inclusive. There is approximately 3,000,000 kw of capacity scheduled for the interconnected Northeast power systems for the same period. In other words, it would take five St. Lawrences to handle the increased requirements in this area during the next four years. Yet Mr. Getchell of the Federal Power Commission attending the St. Lawrence Hearings, tried to force the New York State Power Authority to state how they were going to divide this power among the Northeastern states.

In the Southeastern states surrounding Tennessee to the East and South, the private companies have some 2,000,000 kw of steam capacity scheduled through 1948 to 1952. The 1948 peaks for this group of power companies will amount to over 5,500,000 kw.

Fig. 6, from the National Industrial Conference Board, shows the relative generation by hydro and steam for the various areas in the United States for 1920, 1940 and 1947.

ELECTRIC POWER PRODUCTION BY TYPE OF PRIME MOVER, 1920, 1940, 1947



While the Middle Atlantic and East North Central states produce the bulk of electric power, their share of the total is less than it was in 1920. In that year it was 51%, as against 44% in 1947. Only in the Southern states has there been a steady percentage growth -- from 15% in 1920 to 26% in 1947.

Only three areas -- Pacific, Mountain and East South Central -- produce more than half their electric energy from water power. Except for the East South Central and West South Central states, the relative importance of this source of electric energy has declined.

SOURCE: Federal Power Commission

Fig. 6—Electric Power Production by Type of Prime Mover, 1920, 1940, 1947
(Smaller figures above Bars Indicate Billions of Kilowatthours Produced in Each Region for Each Year)

The Edison Electric Institute committee's latest tabulation indicates an approximate 4 per cent margin between the peak and capacity for this year. This is slightly less than it was a year ago, in spite of the fact that the electric power industry has installed all the equipment that the manufacturers could produce. This year 4,800,000 kw of new electric power equipment is being installed. As shown in Fig. 7, the picture for next year appears considerably better and from then on our margin should materially increase.

The Truth About "Power Shortages"

We have had such scare headlines as the article "Your Lights Are Going Out," which grossly distorts the picture. It is not a question of the lights going out. It is a question of the lesser margin forcing some load adjustments over peak periods when the weather gives us low water, the skies are cloudy and we have equipment outages.

During the peak in December 1947, a check of 98 per cent of the industry showed the following load adjustments.

By voltage reduction	131,000 kw
By shifting load to off-peak periods	49,000 kw
By voluntary customer curtailment	43,000 kw
Other curtailments	10,000 kw
	233,000 kw

The total of 233,000 kw was approximately ½ of 1 per cent of the total load.

In addition to the above there was 384,000 kw of interruptible load that was not on during the peak period. This latter was in accordance with normal practice. These adjustments only held on over the peak period of the day. It is to be noted that this did not affect any vital service. In previous months, corresponding load adjustments were made from time to time when combinations of low water, dark weather and unexpected outages brought tight situations in various areas.

With the continued unusual increases in load, corresponding situations are liable to occur throughout the next few months. This might cause some slight inconvenience but will have no appreciable effect on our industrial output or mode of living. Most certainly it will have an infinitesimal effect on the vast majority of electric power users. Unless we have a catastrophe, it will in no way approach the effects of the sleet storm last year, nor will it have the remotest relationship with the 20 per cent curtailments in electrical uses by the Ontario-Hydro Commission.

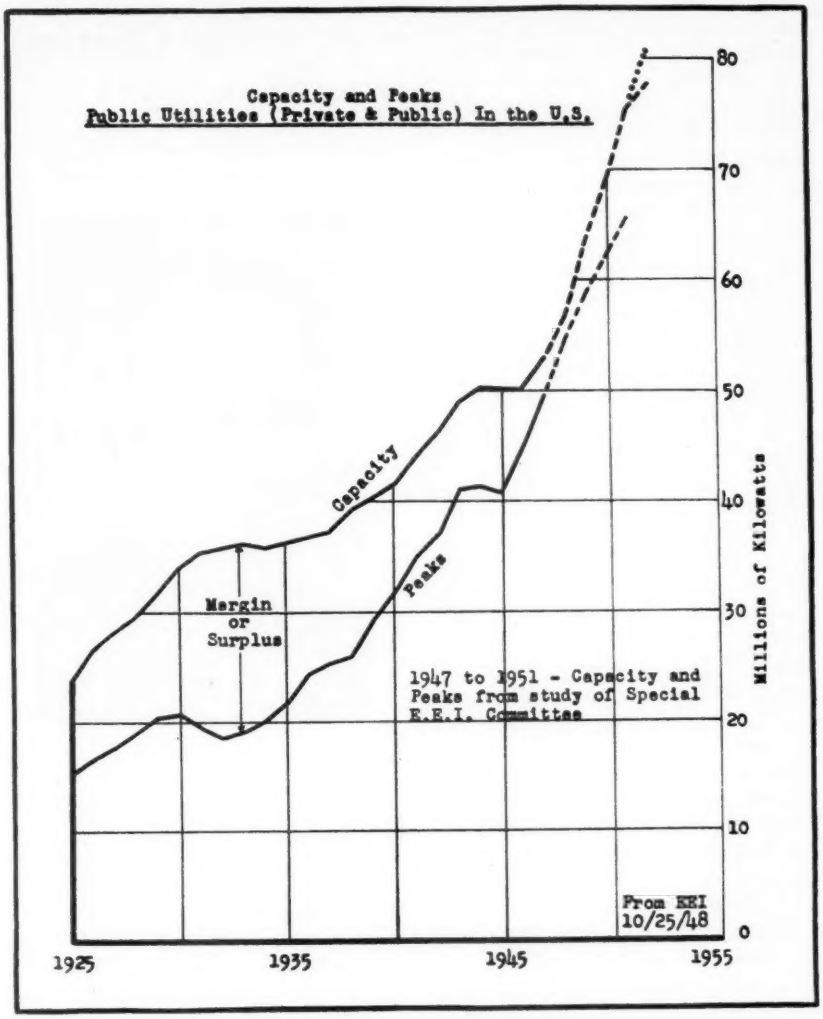


Fig. 7—Capacity and Peaks of All Electric Utilities (Public and Private) in the U. S., 1925-1948

So far I have been telling you about the capacity and the load. It is equally important to give an understanding of the transmission grid that now covers the country and which allows for the most excellent power pooling which is in effect. Between World War I and World War II, the power areas were quite completely interconnected. This desirable condition was interfered with to some extent by certain Federal laws and their interpretation. In 1940, the National Power Policy Committee, which was checking our power supply in the interest of national defense, had a quite elaborate design drawn up for a super grid to operate at over 200,000 volts.

In designing this super grid the existing interconnections were not taken into consideration and therefore would have been duplicated. A quite detailed study of this proposal by the electric power industry showed far less savings than the NPPC report and showed far greater costs of constructing and operating the grid. The project was vetoed — principally by the Army and Navy representatives. Its construction would have taken very needful materials from other phases of the preparedness program and war effort.

The wisdom of vetoing this program is shown by the fact that few additional interconnections were needed throughout the war period. Some were constructed under exemption from the Federal laws. A number of these were removed after the war. Other transmission lines were

constructed to take care of the increased capacity and/or load in various sections. The operation in all such areas is coordinated through pooling groups.

Each interconnected section of the country has a power pool or its equivalent, operating under a committee appointed by the independent companies in the area. Most of these pooling groups were operating as units previous to the war. During the war they were under the general supervision of the Office of War Utilities. There was continual improvement in the coordination. Since the war, these pools have continued. Technical advancements along these lines have been as great since the war as they were during the war period.

Our committee, in coordination with the man who so ably and accurately predicted loads for WPB throughout the war, estimates that there will not be a great difference between the probable loads under peacetime or under war conditions if such conditions should unfortunately arise.

Under such conditions, undoubtedly, we would have daylight saving time throughout the year. In contrast to the situation back in 1941, we are now at a maximum of production. Steel and iron are being used as fast as they can be produced. Many other commodities are in short supply. There is some idle factory space which would undoubtedly be in use now if manpower were available. War requirements would have to supersede civilian use and practically all of the materials for any war effort would have to come by conversion. The domestic use of power has doubled since 1940. Commercial use has come up 50 per cent. There is a possibility that some of this might be curtailed, if necessary. However, political consideration shied away from this during the last war and would probably do the same in any future hostilities.

Brownout was a subject of great discussion throughout the last war. Against the advice of the OWU and of the WPB, it was forced through needlessly as a hair shirt proposition in the first part of 1945. The saving from brownout is relatively insignificant except for what possible psychological value it might have.

Let me summarize as follows:

1. Except for one area where normal development was retarded by governmental policies there were excessive reserves during the thirties

(*Continued on page 390*)

Charles E. Snyder

CHARLES E. SNYDER, head of the New Business Department of the Monongahela Power Company, and a member and past Chairman of the Industrial Power and Heating Section of the Commercial Division of the Edison Electric Institute, died on October 20 at the General Hospital in his home city of Fairmont, West Virginia. Mr. Snyder's death followed a heart attack suffered the day previous while on a hunting trip with friends.

MR. SNYDER

Widely known throughout the industry for his contributions to the commercial activities of the industry, particularly in the field of industrial sales development, Mr. Snyder's spirit of cooperation, personal modesty, and sincerity, exemplified by his genuine interest in those with whom he came in contact, had made him one of the most generally beloved men in the industry.

Born at Earnshaw, a small community in Wetzel County, Penna., where he gained his early education, Mr. Snyder entered West Virginia University with the class of 1924. He was an outstanding student and received his bachelor of science degree in electrical engineering.

After two years in General Electric Company in a test course, he went to the Monongahela company on June 14, 1926, as a commercial representative in sales, then in 1929 became a special representative. Two years later—Jan. 1, 1931—he was named manager of the Rating and Inspection Department and held that position until Feb. 1, 1934, when he became assistant general manager of sales. Eight months later he became head of the New Business Department, continuing in that capacity to the time of his death.

He was a member of the state board of examiners for professional engineers, had been prominent in the West Virginia Society of Professional Engineers for years as an officer and leader in numerous forward-looking activities, and a few years ago completed a study of the physical and educational assets of the College of Engineering at the University, a study which has been widely used by educators, legislators and engineers.

His contributions to the advancement of the industry on a national scale started in 1930 when he became a member of the National Electric Light Association General Power Committee. Serving the industry under EEI auspices he became a member of the Industrial Power and Heating Subcommittee in 1935 and the Diesel Engine Subcommittee in 1936. From this time on, his responsibilities increased to chairman of the Competitive Power Group in 1939, chairman of the committee responsible for the Power Sales Conference in 1940, vice chairman of the Industrial Power and Heating Section in 1943-4, and chairman 1945 and 1946. He was also a member of the Sales Training Committee during its formative stages, a co-author of the Power Sales Manual and a frequent speaker at the Annual Power Sales Conferences. No job was too big and none too small—all were well done.

On October 28th, eight days after his death, the Commercial Division General Committee of the Institute memorialized his passing with these words:

"The members of the Commercial Division General Committee . . . desire to record their high appreciation of his sterling character and lovable personality and their keen feeling of personal loss in his passing.

"His achievements, in the service of his company, his industry and the region in which he lived, will stand as a tangible memorial to the energy and devotion with which he approached every task. By his willing cooperation and sound counsel he held the respect and affection of his colleagues on this Committee."

—A. B. M.

EEI General, Engineering and Accounting Committees Organized to Meet Wide Demands of Industry's Activities

CONTINUING at its record-breaking pace, the electric industry will in 1948 top many of the high marks it set only last year. But the nation's electric companies have a history of precedent-making achievement behind them, and they look forward to years of unprecedented progress ahead, in their never-ending effort to provide every potential benefit that electric power holds for the people of the United States.

This tradition of working in the present toward the future is exemplified in the activities of the committees of the Edison Electric Institute. Every major phase of electric company operation is studied in detail by the Institute's 41 committees, whose more than 950 members are devoted to finding new or improved methods to heighten the industry's efficiency.

The membership of these committees is drawn from the member companies of the Institute and presents a striking picture of group responsibility toward the public which depends in such large measure on its supply of electricity. Representatives of the various companies exchange their experiences and suggestions for better service in committee for the benefit of the industry's residential, commercial and industrial customers.

The reports, recommendations, documents and pamphlets which the committees develop have been circulated by the million among the electric companies and lend valuable assistance in improving local electric service. In addition, the committees watch for indications of future trends and the problems that may arise as a result, and seek to have solutions at hand before the problems themselves occur.

Over-all direction of committee activities, as well as of the Institute, is vested in the Board of Directors, drawn largely from chief executives of the member companies. Serving in a consulting capacity on matters of broad electric utility policy is the Advisory Committee, composed of 29 company executives.

The Board of Directors directs all activities of the General Committees and also exercises supervision over the operations of the Accounting, Commercial and Engineering Divisions.

ERNEST R. ACKER

Chairman of the Board of Directors, EEI, and also President of the Institute. Mr. Acker is the President of the Central Hudson Gas & Electric Corp., Poughkeepsie, N. Y.

The nine General Committees, which report directly to the Board of Directors, deal with accident prevention, industrial relations, insurance, membership, purchasing and stores, prize awards, rate research, statistics, and transportation.

A. H. KEHOE

Chairman of the Committee on Codes and Standards — Vice President, Consolidated Edison Co. of New York, Inc., New York, N. Y.

New General Committees which have been recently authorized by the Board, are a committee on financing and investor relations, the rural and community development committee and a committee on research.

In addition to the General Committees, which have continuing functions, special committees are authorized by the Board from time to time for specific tasks. Such special groups currently in operation, or in the process of organization, are the Special Committee to Investigate a Public Information Program, and a Committee to Investigate an Appliance Specifications and Testing Program.

Committee on Codes and Standards

A subcommittee of the Board of Directors, the Committee on Codes and Standards, under Chairman A. H. Kehoe of Consolidated Edison Company of New York, Inc., has jurisdiction over a variety of activities and technical regulations, including codes and standards.

The Committee acts as an important liaison between the electric industry and groups representing other industries as well as such organizations as the National Electrical Manufacturers Association and the National Fire Prevention Association.

One of the Committee's major interindustry responsibilities is the supervision of electric industry representatives on committees dealing with the coordination of plant facilities of the telephone, telegraph, and railroad industries.

The Committee is responsible also for the electric industry's role in some sixty committees of the American Standards Association which are endeavoring to establish electrical standards for nationwide application.

The activities and plans of the committees of the Commercial Division for the current administrative year were outlined in last month's issue of the BULLETIN. This article surveys the work of the General Committees of the Institute, and those of the Accounting

EEI General Committees

Accident Prevention Committee

The Accident Prevention Committee under the chairmanship of E. J. KREH, Duquesne Light Company, Pittsburgh, Pa., has as its major objective, plans for the research of factors producing recent increases in the frequency and severity of employee-disabling accidents, which in 1946 reached a sixteen-year highpoint. Notice of this alarming trend has gone forward to the chief executives of all member companies inviting them to make every effort to achieve a 25 per cent reduction in 1948. Replies give assurance of generous support. Companies who reach this goal will receive recognition for their achievement at the annual convention of the Institute in 1949.

The committee plans to continue its usual program which is concerned with the development of educational material, manuals of instructions, safe practice pamphlets and sound-slide and motion picture films. All of these are based upon its continuing study of accident causes. Those near completion are: "Use and Care of Hot Line Tools"; "Handling, Storage and Transportation of Poles"; "Causes and Means of Control of Generating Station Accidents"; a new manual on employee safety training and a variety of other items.

Need for improvement in life saving technique following electric shock has also been recognized. A detailed proposal for extensive research on resuscitation at Johns Hopkins University has been presented to the Institute for approval.

E. J. KREH

Chairman of the Accident Prevention Committee — Manager, Accident Prevention, Duquesne Light Co., Pittsburgh, Pa.

Industrial Relations Committee

The Industrial Relations Committee, with C. B. BOULET, Wisconsin Public Service Corp., Milwaukee, Wis., as Chairman, has laid plans for a continuation of the effort begun last year to find a better basis for understanding between employees and management.

The Committee's program, in addition to its regular meetings, provides for joint sessions with regional groups and also with the American Gas Association Industrial Relations Committee.

As an aid to public utilities in collective bargaining, the Committee is likewise conducting a three-day conference on this subject. The discussions at this meeting will cover such subjects as union security; seniority; grievance procedure; arbitration; pensions and wage patterns.

Problems incident to the relations of employers and employees are multiplying and changing daily, primarily because of recent Supreme Court decisions and changes in labor legislation. It is a certainty that there will be considerable new legislation governing these relationships as well as changes in present legislation. Recognizing these facts, the Committee has arranged to keep the industry advised as to these proposed changes and wherever possible, to secure from representative companies their reactions and opinions relating to legislative changes. A subcommittee headed by Fred Rauch, Vice President of the Cincinnati Gas and Electric Company, has been given this responsibility.

C. B. BOULET

Chairman of the Industrial Relations Committee—Director of Personnel, Wisconsin Public Service Corp., Milwaukee, Wis.

Another important activity of the Committee during the current year relates to the arbitration of public utility disputes, either on a voluntary basis or under state law where strikes by public utility employees are prohibited and arbitration substituted. It is recognized as increasingly important that member companies should be kept fully informed as to the results of such arbitration and the techniques used by arbitration experts employed by labor organizations. Plans are being made to establish a clearing house for this information in order that such material can be distributed on a wide basis.

The Committee will continue to collect and circulate information on current labor negotiations in the utility field, wage rates on both a regional and national basis and personnel policies.

A subcommittee of the Industrial Relations Committee under the chairmanship of H. K. Breckenridge, Vice President of West Penn Power Company, working in conjunction with representatives of EEI Committees in the Accounting, Engineering, and Sales Divisions, has prepared a booklet for use by the industry in interesting college graduates in selecting the electric light and power field for their careers. This booklet will be available for distribution about December 10th.

Another subcommittee on Employee Testing has been set up under chairman W. N. Cummins of Virginia Electric & Power Company. This is to be a continuing activity designed to develop a testing program to meet the particular needs of the industry.

Insurance Committee

The Insurance Committee is under the Chairmanship of I. M. CARPENTER, Manager of the Insurance Department of Ebasco Services Inc., New York, N. Y.

On July 1, of this year, the moratorium granted to the insurance business following the Supreme Court decision that Insurance was Commerce ended, and the full impact of the Sherman Anti-Trust Act, the Robinson-Patman Act and other Federal Laws which relate directly or indirectly to Commerce became effective. Although this moratorium ex-

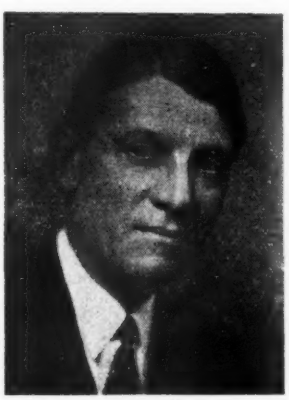
I. M. CARPENTER

Chairman of the Insurance Committee—Insurance Department Manager, Ebasco Services Inc., New York, N. Y.

tended for a period of over two years, there are still many insurance problems which have not as yet been solved and the Committee will continue to watch all developments closely in so far as they relate to the electrical utilities.

For many years, the electrical industry has been considered a preferential class in so far as fire and allied lines of insurance are concerned. It is not now looked upon as being in that category by insurance underwriters, it being their contention that the loss experience has been adverse in recent years. The questionnaires which were submitted to all member companies of the Institute requesting fire insurance experience for the past five years have now been received and tabulated by the Committee. Conferences will be held during the current year with representatives of the fire insurance industry to discuss ways and means to improve the position of the electrical industry from the standpoint of this form of insurance. The insurance interests are endeavoring to increase the rates which would apply to the whole industry and the activities of the Committee will be directed toward holding any such action to an absolute minimum.

As in prior years, close cooperation with other Committees of the Institute will be continued.



J. F. FOGARTY

Chairman of the Membership Committee—Chairman, Executive Finance Committee, The North American Co., New York, N. Y.

Membership Committee

The Membership Committee has as its Chairman, J. F. FOGARTY of the North American Company, New York, N. Y. All applications for membership in the Institute are examined by this Committee, and the Committee's reports and recommendations are made to the Board of Directors.

Prize Awards Committee

All prize awards, with the exception of the Charles A. Coffin Award, come under the jurisdiction of the Prize Awards Committee, headed by H. M. SAWYER of the American Gas and Electric Service Corp., New York, N. Y. The committee administers the awards given by various donors for sponsorship by the Institute, and appoints the judges of the contests. Consideration of new prizes offered for Institute sponsorship is also a committee responsibility. For full details on the 1948-1949 prize competitions, see page 385 in this issue of the BULLETIN.

Purchasing and Stores Committee

The Purchasing and Stores Committee, with R. W. T. PURCHAS of Middle West Service Co., Chicago, Ill., serving as Chairman, has a membership with duties divided about equally between purchasing and stores functions.

Projects for the 1948-49 year will include methods, facilities and personnel employed in purchasing and stores operations and will be assigned to individual project committees for study and report. This is a new procedure aimed at active participation by a larger number of the committee members.

Continued from the 1947-48 year is the work of the committee on Standard Packaging. Very substantial progress has been made by this committee in connection with standard packaging for about 1200 items of line hardware. A comprehensive report with recommendations is

H. M. SAWYER

Chairman of the Prize Awards Committee — Vice President, American Gas & Electric Service Corp., New York, N. Y.

scheduled for the April, 1949, meeting of the Purchasing and Stores Committee.

Assignment on other activities has not yet been completed.

Rate Research Committee

The Rate Research Committee, with S. W. ANDREWS of the American Gas & Electric Service Corp. as Chairman, will hold at least 3 meetings during the current year. These meetings will be largely devoted to round-table discussions of current rate problems. Recent rate changes was the main subject at the September meeting.

Standing committees will continue the study of Electric Utility Costs under Chairman H. I. Miller of the Wisconsin Public Service Corp., Oshkosh, Wis.; Return in the Electric Utility Industry,

R. W. T. PURCHAS

Chairman of the Purchasing and Stores Committee—Supervisor of Purchasing, Middle West Service Co., Chicago, Ill.

led by Chairman E. N. Strait of the Pioneer Service and Engineering Co., Chicago, Ill.; and Standby and Auxiliary Rates under the chairmanship of L. W. Frank of the Western Massachusetts Electric Co., Springfield, Mass. Mr. Frank has also been assigned the responsibility of keeping a running compilation of Rate Developments. L. R. Lefferson has been named chairman of a new subcommittee on Residential Rates, which will investigate broader aspects in the light of present-day conditions. Particular attention will be paid to the new residential loads with large demand responsibilities.

The 1949 issue of the EEI Rate Book will be published in the Spring and it is now planned to include all changes through January, 1949.

S. W. ANDREWS

Chairman of the Rate Research Committee — Rate Engineer, American Gas & Electric Service Corp., New York, N. Y.

Cooperation with other divisions of the EEI on projects of mutual interest will continue as in the past.

Statistical Committee

The Statistical Committee with O. E. SMITH, Consolidated Gas Electric Light and Power Co., Baltimore, Md., as Chairman, makes available factual data relating to the industry for use by the industry and the public. The Committee strives to keep abreast of the need for such data and supervises its release in the most effective and usable form. Statistical reports compiled by the Statistical Department of the Institute are released weekly, monthly and annually, and interim reports are made on timely subjects.

O. E. SMITH

Chairman of the Statistical Committee — Assistant to the President, Consolidated Gas Elecric Light and Power Co., Baltimore, Md.

The Committee is continuing its studies relating to additional information which will contribute to the usefulness of the Institute's services and is studying ways and means of improving the comparability of data reported by cooperating companies.

Forms sent out for the gathering of information will be reviewed by the Committee before their release to insure that only essential information is requested in a manner readily available in the records of most companies.

The annual Statistical Bulletin will be reviewed for the purpose of making the information contained therein most effective for use by both industry and the public.

Transportation Committee

The Transportation Committee, under Chairman LINN EDSALL of the Philadelphia Electric Company, Philadelphia, Pa., is concerned with the problems associated with operation and maintenance of electric utility motor vehicles and the development of improved designs and practices in this field. Since much of this work is of common interest to the electric and gas utilities, this committee cooperates closely with the AGA Motor Vehicle Committee.

The major meeting of the year is the Annual Conference of Utility Fleet Operators, sponsored jointly by the AGA and the EEI committees, to be held in Cincinnati next April. This will feature selected papers by leaders in the automotive field on important matters of current interest, with ample opportunity for general discussion following these presentations. Among the topics to be covered will be such new problems as operating and maintenance experience with light trenchers and also with new equipment employed in right-of-way clearing.

LINN EDSALL

Chairman of the Transportation Committee—General Superintendent, Philadelphia Electric Co., Philadelphia, Pa.

The AGA-EEI Joint Subcommittee on Body Standardization has its recommendations on small truck bodies practically completed and will soon be in a position to start working on the larger line construction type of body.

A new subcommittee will be set up this year to study mobile equipment requirements, including the basis of rating truck ladders, for servicing street lights at the higher mounting heights now being tried out in several locations. Another new subcommittee will investigate the method of rating mobile pole derricks.

READY NOW

"I want to know about

THE ELECTRIC INDUSTRY"

The answers to 24 Questions frequently asked about the Industry.

Ask for a Copy

EDISON ELECTRIC INSTITUTE

420 Lexington Ave., New York 17, N.Y.

Engineering Division Committees

The Engineering Division is made up of six committees, and these with their subdivisions are primarily concerned with the operation and maintenance of electric plant and equipment. In addition, standards are developed and recommended. The expansion program has caused emphasis to be placed on the study of design, construction and operating problems, with their effect on cost reduction.

Engineering Division General Committee

The Engineering Division General Committee under the Chairmanship of E. W. DILLARD, New England Power Service Co., Boston, Mass., coordinates and supervises the work of all the engineering committees. Its membership consists of fifteen members-at-large, drawn from the engineering executive ranks of member companies, together with the five engineering committee chairmen.

In addition to the task of general guidance, the Committee also considers those matters which, because of their major economic aspects, require overall policy review or action—as, for example, recommended standards developed in the engineering committees.

The Committee also sponsors certain projects of broad interest to the engineering committees. In this category falls the joint work on branch circuit protection started last year in cooperation with the AEIC. This involves basic study of overcurrent protection with particular reference to the wiring of residential occupancies. The results of this investigation will assist the work of the NFPA and other groups concerned with this problem. The Engineering Division General Committee has also cooperated with the Industrial Relations Committee in the preparation of a booklet for the information of college graduates regarding careers in the electric light and power field.

Electrical Equipment Committee

The Electrical Equipment Committee with B. VAN NESS, JR., Pennsylvania Water & Power Co., Baltimore, Md., as Chairman, devotes its attention to the technical characteristics of electrical equipment; to the fundamental principles of design of electrical installations in power stations and substations; to the engineering and economic problems involved in the application and use of electrical equipment in integrated and interconnected power systems; to the review of operating experiences and maintenance problems; and to the guiding of the economic development of approved practices in the electric field of utility operations.

E. W. DILLARD

Chairman of the Engineering Division General Committee—Chief Engineer, New England Power Service Co., Boston, Mass.

The 56 members of the Electrical Equipment Committee represent 47 companies in the electric utility field. In this group are specialists in electrical design, construction, system engineering, and operation and maintenance. For administrative purposes the committee operates in five divisions, but these are not considered to be subcommittees and the members serve in all divisions.

B. VAN NESS, JR.

Chairman of the Electrical Equipment Committee — Pennsylvania Water & Power Co., Baltimore, Md.

The Apparatus and Design Division, H. B. Wood, Chairman, is sponsoring round-table discussions of apparatus troubles, oil fires, new equipment purchases and the relation of these problems to design and construction. This division also is concerned with rotating machinery, station design, switchboards and switchgear, and generator insulation.

The various aspects of system planning, system generating capacity reserves, intersystem power exchange practices, are given active consideration by the System Engineering Division under the chairmanship of S. M. Hamill, Jr.

E. S. Fitz, Chairman of the Operating and Maintenance Division, is planning to consider this year operating problems incidental to the starting of new stations, unusual maintenance practices, particularly those directed toward reduction in outage time, personnel practices and, as before, the place of safety in design, operation and maintenance.

The problems associated with heavy electrical equipment in industry are of major interest to the Electrical Equipment Committee. Included in this classification are large motors, rectifiers, electric welders, electric furnaces, or other equipment which create unusual power demands, voltage dips, or wave distortion on supply systems. Problems arising from such applications are handled by the Utilization Division under the direction of J. H. Foote, Chairman.

The Foreign Practice Group, under the chairmanship of A. V. DeBeech, functions as a clearing house for the exchange of information on electrical equipment problems between the Electrical Equipment Committee and correspondents throughout the world. This service is proving most valuable to both foreign members and our own committee.

During the war the activities of the Electrical Equipment Committee were largely centered on problems arising out of operation and maintenance under heavily restricted circumstances. Today, with an enormous expansion program being undertaken at high price levels, more time is being devoted to design, construction and the operating problems associated with expansion and cost reduction.

G. R. STRANDBERG

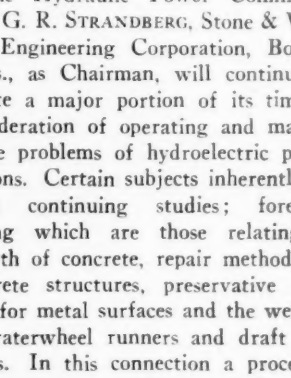
Chairman of the Hydraulic Power Committee—Chief Hydraulic Engineer, Stone & Webster Engineering Corp., Boston, Mass.

Hydraulic Power Committee

The Hydraulic Power Committee, with G. R. STRANDBERG, Stone & Webster Engineering Corporation, Boston, Mass., as Chairman, will continue to devote a major portion of its time to consideration of operating and maintenance problems of hydroelectric power stations. Certain subjects inherently require continuing studies; foremost among which are those relating to growth of concrete, repair methods for concrete structures, preservative coatings for metal surfaces and the welding of waterwheel runners and draft tube liners. In this connection a procedure has been set up to obtain annual reports on unusual changes observed regarding the life of major dam repairs.

A substantial portion of the time at meetings is devoted to the successful "round-table" method of discussion. Prepared lead-off presentations by various members serve to direct attention to the more important current problems. Provision is also made for a few papers on new developments in the design and construction of hydro stations.

Expansion of the committee membership continues, with eight new members added this year. The committee comprises a representative cross-section of member companies especially interested in hydro projects and naturally includes a substantial number from the western part of the country. In order to maintain closer contact with this group, arrangements are being made to hold the 1949 spring meeting in the west.



H. M. JOHNSON

Chairman of the Meter and Service Committee—Meter Engineer, New England Power Service Co., Boston, Mass.

Meter and Service Committee

The Meter and Service Committee under Chairman H. M. JOHNSON, New England Power Service Co., Boston, Mass., inaugurated its current activities with a meeting held jointly with the AEIC Committee on Metering and Service Methods at Raleigh, N. C., Oct. 4 to 6, 1948. The Committee has a membership of thirty-six with an equal number of corresponding members, providing a well distributed national representation.

Vice-Chairman of the Committee is H. A. Brown, Rochester Gas & Electric Corp., and the Secretary is Frank A. Redding, Southern California Edison Co., Alhambra, Calif. Current organization of the group comprises some sixteen subcommittees. Each of these subcommittees has under consideration a specific problem or project such as Revision of Metermen's Handbook, Watthour Meter Development, High Voltage Meter Installations, etc. Industry standards related to Essential Meter Markings, Demand Registers and Watthour Meter Sockets are nearing completion.

Prime Movers Committee

The Prime Movers Committee with a membership of 70, under Chairman G. C. DANIELS, The Commonwealth & Southern Corp., Jackson, Mich., is planning to hold four meetings during the ensuing year, with the first meeting in Pittsburgh, Oct. 11 and 12.

This committee functions through various subcommittees who in general issue published reports. These subcommittees are as follows: Boiler Auxiliaries, Boilers and Combustion, Gas Turbines, Metallurgy and Piping, Oil and Gas Power, Power Station Chemistry, Power Station Data, Turbines and Condensers, Coal and Ash Handling, Smoke and Fly Ash Abatement, and Power Plant Personnel. The last three subcommittees are new ones this year, since there is a growing demand for information on these subjects.

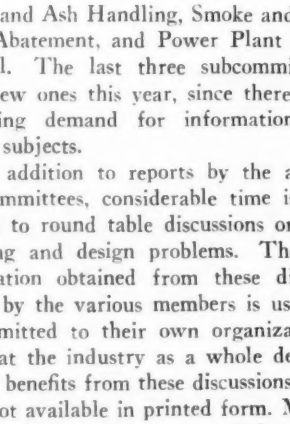
G. C. DANIELS

Chairman of the Prime Movers Committee — Chief Engineer, The Commonwealth & Southern Corp., Jackson, Mich.

In addition to reports by the above subcommittees, considerable time is devoted to round table discussions on operating and design problems. The information obtained from these discussions by the various members is usually transmitted to their own organizations so that the industry as a whole derives great benefits from these discussions that are not available in printed form. Much of this information is more or less confidential in nature.

Transmission and Distribution Committee

The Transmission and Distribution Committee, T. J. BROSNAN, Buffalo



T. J. BROSNAN

Chairman of the Transmission and Distribution Committee—Distribution Engineer, Buffalo Niagara Electric Corp., Buffalo, N. Y.

Niagara Electric Corp., Buffalo, N. Y., Chairman, held its fall meeting for the 1948-49 season at Swampscott, Mass., on Oct. 11 and 12. The winter meeting is scheduled for Cincinnati in February and the spring meeting will be held in Chicago in May.

Care is being taken to maintain a proper balance between the consideration of broad and fundamental questions of design and operation and the work on detailed items such as specifications for equipment. Some idea of the scope of the activities is given by the following list of the subdivisions of the organization.

The Executive Committee directs the activities of the Transmission and Distribution Committee. Its membership includes T. J. Brosnan, Chairman; C. K. Poarch, Secretary; H. P. Seelye and E. V. Sayles, Past Chairmen; L. G. Smith, Sponsor of Overhead System; J. A. Pulsford, Sponsor of Underground System; J. E. McCormack, Sponsor of General Engineering; W. E. Losie, Sponsor of Standards and Specifications; C. E. Bathe, Sponsor for Safety in Design, Construction and Operation.

The subcommittees and their chairmen include Pole Line Hardware, E. K. Karcher; Timber Products, F. A. Ashbaugh; Street Lighting, R. J. Palmer; Insulators, R. M. Havourd; Fuses, W. L. Vest; Connectors and Splices, R. M. Havourd; Radio Frequency Allocations, W. C. Phillips; Utilization Equipment, J. W. Anderson; System Load Characteristics, H. A. Enos; Cable Operation (Joint with AEIC), C. J. Beller and J. Pokorny; Network System Operation, J. A. Pulsford; Nonmetallic Sheath Cable, R. E. Morse; Coordination of Design and Protection (Joint with AIEE), C. J. Beller; Capacitor Performance (Joint with AIEE) H. E. Stites; High Voltage Line Outages (Joint with AIEE), M. H. Pratt.

Accounting Division Committees

The Institute's Accounting Division will continue to work in close cooperation with the Accounting Section of the American Gas Association. The interests of the two groups are largely identical and much wasteful duplication of effort is avoided by a joint attack on their common problems. In the following outline of the tasks that have been selected as promising most fruitful results during the current administrative year it should be understood that unless otherwise stated the work will be undertaken jointly by AGA-EEI committees in cooperation.

Accounting Division Executive Committee

Heading up the work of the division is the Accounting Division Executive Committee, formerly known as the Accounting Division General Committee, whose name has now been officially changed, without change of function, to avoid confusion with the Committee on General Accounting. The new chairman for the committee, and therefore the ranking leader in the Division activities is ALLAN G. MITCHELL, Philadelphia Electric Company. The vice-chairman is W. H. ZIMMER of The Cincinnati Gas & Electric Company. The Executive Committee coordinates and supervises the work of all other committees, through subcommittees undertakes research and reports on projects of broad interest to all utility accountants rather than to any functional division of an accounting department. Two or three times during the year the committee meets for informal discussion and exchange of ideas and experiences which may or may not bear fruit in a written report. Subcommittees of the Executive Committee this year will be:

A. G. MITCHELL

Chairman of the Accounting Division Executive Committee—Statistician, Philadelphia Electric Co., Philadelphia, Pa.

1. Financing Capital Requirements

This subcommittee, made up of member company officers who have financing as one of their principal responsibilities, has undertaken jointly with a corresponding committee of the AGA an investigation of public utility financing problems. The committee has divided its field into eight areas or topics, each of which has been assigned to two individuals. The problems and the names of the men who will study them are listed by the chairman, H. H. Scaff, Ebasco Services Inc., as follows:

a. Information Program: L. D. Webber, Southern California Edison Co.; R. McDowell, The Peoples Gas Light & Coke Co.
b. Determination of Requisite and Allowable Earnings: E. W. Morehouse, General Public Utilities Corp.; H. L. Gruehn, Consolidated Gas Electric Light & Power Company of Baltimore.
c. Impact of Competitive Bidding on Utility Financing: H. H. Scaff, Ebasco Services Inc.; E. W. Morehouse, General Public Utilities Corp.
d. Investor Relations: W. E. Caine, Texas Eastern Transmission Corp.; A. H. Schettler, Union Electric Company of Missouri.
e. Relations with Underwriters and Dealers: H. A. Busch, General Public Utilities Corp.; H. P. Taylor, Wisconsin Public Service Corp.
f. Characteristics of Securities: W. G. Bourne, The Commonwealth and Southern Corp.; F. H. Crissman, Columbia Gas System, Inc.
g. Impact of Federal Taxation on Utility Financing: C. E. Eble, Consolidated Edison Company of New York, Inc.; H. H. Scaff, Ebasco Services Inc.
h. Problems Peculiar to Straight Gas Companies: G. C. Griswold, Brooklyn Union Gas Company.

The results of these studies will, it is hoped, be embodied in a report to be forthcoming within the next two or three months.

2. Employee Relations

This subcommittee, headed for EEI by A. W. Smith, Worcester County Electric Company, and made up of representatives of both general accounting and customer accounting activities, has sev-

eral interesting subjects for study under consideration but has not decided which ones it will devote its principal attention to. Among these topics are: 1) Employee Training Programs; 2) Office Rules and Regulations and Their Effect on Employee Efficiency; 3) Job Evaluation in Terms of Pay.

3. Accounting Developments Service

This subcommittee includes members representative of both the two broad fields into which public utility accounting naturally divides itself, general accounting and customer accounting. Its EEI co-chairman will be C. J. Wardell, The Commonwealth and Southern Corp. Its function is to assemble, select, and distribute to industry accountants descriptions of new and improved methods, procedures, machines, devices, and equipment which the committee members believe will be helpful to utility accountants. At present the committee contemplates issue of bulletins over three months. The first one has been mailed with an initial transmittal letter dated September 27, to all chief accounting officers of member companies and all members of accounting division committees. Comments thus far received have all been highly commendatory.

Committee on Application of Accounting Principles

The Committee on Application of Accounting Principles, another committee which has no counterpart in the AGA Accounting Section, will continue without change of chairman or vice-chairman. These are H. H. SCAFF, Ebasco Services Inc., and W. H. SWINNEY, West Penn Power Company, respectively. It considers as they arise questions of accounting principles that apply to the electric light and power industry. There is at present before the committee a proposed bulletin of the Committee on Accounting Procedure of the American Institute of Accountants dealing with the accounting for past service annuity costs under pension plans. This is a subject of great interest to utility management and has been an important issue in some recent rate cases.

Customer Activities Committee

The Customer Activities Committee, chairman, R. G. SCHNEIDER, Virginia Electric & Power Company, vice-chairman, J. D. ELLIOTT, The Detroit Edison Company, divides its work into three principal categories: Customer Accounting, Customer Relations, and Credits and Collections. Each of these has a

H. H. SCAFF

Chairman of the Committee on Application of Accounting Principles—Vice President, Ebasco Services Inc., New York, N. Y.

separate subcommittee which works closely with a similarly titled committee of the AGA's Accounting Section. The three principal subcommittees have each undertaken a number of projects for joint study with their AGA cooperators. These projects are described below.

Customer Accounting Committee: Chairman, W. J. Ott, The Cincinnati Gas & Electric Company.

1. Work simplification applied to customer accounting work. Efforts to find ways to offset rising office costs.
2. Survey of company organizations for handling customer accounting work. Organization systems and charts and their effect on accounting office costs.
3. Most comprehensive development of punched card systems of customer accounting and mark sensed meter reading. Outline of accomplishments of the most comprehensive development of punched card customer accounting systems.
4. Customers' accounting costs and production comparisons. Comparative production yardsticks in recent years, specifically meters assigned and read per man per day; and employees per 10,000 accounts.
5. "Sacred Cow" Project. The objective of this committee is to question certain practices and records often regarded as "indispensable" and to cite examples of what has happened in companies which have ceased to worship these "Sacred Cows."
6. Service and meter order routines and records. Methods of processing orders from the first application by the customer to the final execution in the field, with special reference to records maintained and the way in which they are filed.
7. Meter reading sheets and bill forms. The project committee will collect and prepare for exhibition at the next joint accounting conference, bill forms and meter reading sheets.

R. G. SCHNEIDER

Chairman of the Customer Activities Committee — Virginia Electric & Power Co., Richmond, Va.

Customer Relations Committee whose chairman is F. J. Porter, Jr., of the Consolidated Edison Co. of New York, Inc.

1. Favorite customer relations procedures and practices. A round-table discussion of practices and procedures, minor in nature, which contribute that little extra touch in improving customer-company relations.
2. Customer Relations is Everyone's Business. A paper stressing the need for recognizing and doing something about customer relations on the part of all employees (collections, servicing, billing, meter reading, etc.)
3. Branch Offices—An Asset or a Liability. A paper outlining those practices of branch office operations which contribute to improved customer relations such as design of cashiers' cages, "Musak," customer lounge chairs, attendants, decorations, directional signs, etc.
4. Are We Training Employees to Meet the Public? A paper presenting the extent of customer relations training programs now in use in the industry, an evaluation of them, and an attempt to point out the next step in this field.

5. Are Our Rates Understandable? A paper discussing the problem of explaining to the customer some of the rate clauses which are technical in nature, such as the fuel charge, the demand charge, the prompt payment discount, etc., with the inference that perhaps they are not worth the trouble they cause.
6. Customer Attitude Toward Collection Notices. A paper reviewing known attitudes of customers toward the various types of collection notices commonly used in the industry, with emphasis on changes which will make them more acceptable.
7. How telephone collection activities affect customer relations. Discussion of experiences with telephone collection activities as a tool to promote good customer relations.

Credits and Collection Committee with chairman J. D. Elliott, The Detroit Edison Company, presiding.

1. Collection experience of the gas and electric industries. A compilation and summary of collection experience by member companies. The project will include reports on significant credit factors such as uncollectible bills, bankruptcies, outstanding accounts receivable, unhonored checks, disconnection notices, and others. It is hoped to make this a continuing project with new data each year or possibly every six months or even every three months.
2. Basic collection practices. Summary of fundamental policies and practices from the time when the bill is rendered to ultimate payment or the cutting off of the service.

Depreciation Accounting Committee

The Depreciation Accounting Committee, which is a committee of the EEI Accounting Division only, will again be headed by A. H. KUHN, Pioneer Service and Engineering Company, Chicago, with FRED ECKSTEIN, New Orleans Public Service, Inc., as vice-chairman. This committee deals with some of the most troublesome and controversial questions in the whole field of public utility accounting and their impact on financing and rate making problems. It hopes to complete during the year a report on methods of estimating service lives of utility property which will deal chiefly with the statistical analysis of past experience but will point out the limitations of these methods and the difficulties

A. H. KUHN

Chairman of the Depreciation Accounting Committee — Vice President, Pioneer Service and Engineering Co., Chicago, Ill.

of applying the results to the determination of appropriate provisions in the books of account to recognize the fact of depreciation. As planned, the report will discuss the relation of service life estimates to depreciation charges and reserves without recommending any one method or formula for depreciation accounting.

During the administrative year just concluded, a subcommittee of the Depreciation Accounting Committee, cooperated with representatives of the National Association of Railroad and Utilities Commissioners, the American Gas Association, and other industries in which studies of property mortality experience are deemed useful, in the preparation of a report entitled "Letter Symbols for Mathematics of Depreciation." This report is an apparently successful attempt at agreement for the first time among engineers and statisticians who employ

E. L. CASSADY

Chairman of the General Accounting Committee—Assistant Treasurer Indianapolis Power & Light Co., Indianapolis, Ind.

mathematical processes in the analysis of past mortality experience of public utility physical property, and attempt to project such experience into an uncertain future, to use the same mathematical symbols for the same mathematical functions.

General Accounting Committee

The General Accounting Committee covers a very broad field, including all matters directly connected with what accountants commonly refer to as the general books. Its chairman is E. L. CASSADY, Indianapolis Power & Light Company; its vice-chairman, A. FRAZER, West Penn Power Company. Work is divided among the following subcommittees, each of which has undertaken to study and report on one or more projects as indicated.

1. Functional or Responsibility Accounting

Chairman, Louis Provencher, The Detroit Edison Company. Studies this year will be particularly directed to (a) the feasibility of complete functional classification of all costs with one or more examples of classifications actually in use; (b) the degree of refinement necessary for best results; (c) standards of performance (physical quantities) for adequate measure of functional efficiency.

2. Clarification of Reports to Stockholders, Employees, and the General Public

Chairman, A. C. McMenemen, Boston Edison Company. This committee will undertake to study methods of presenting financial facts in a form and language readily understandable to persons unfamiliar with conventional accounting terms.

3. Internal Auditing

Chairman, C. J. Nichols, Consolidated Gas Electric Light and Power Company of Baltimore. The committee will study and report on internal audit methods and procedures, with special reference to (a) relationship to the accounting work under audit; (b) correlation with independent auditors; (c) auditing records and accounts of companies which depend largely on tabulating machines and other mechanical accounting devices.

4. Machine Applications for General Accounting

Chairman, Harry Jeffs, Queens Borough Gas and Electric Company. This committee will report on new machine installations, describing actual equipment and procedures.

5. Methods of Payroll Distribution

Chairman, Crad Brazel, Duquesne Light Company. The committee will study methods and procedures in actual use for distributing payroll costs, including the perplexing details of overtime, shift differentials, emergency call-out time, and similar matters, with particular emphasis on trying to find out and report effective short-cuts and simplifications of routine.

6. Uniform Classification of Accounts

Chairman, O. K. Boyd, Consolidated Gas Electric Light and Power Company of Baltimore. This committee's specific assignment is the revision proposed in Wisconsin of the classification of operating expense accounts recommended by the National Association of Railroad and Utilities Commissioners and now used by Wisconsin utilities. A committee of the Wisconsin Utilities Association has been working on this proposal for a considerable period and has asked the advice of the Institute's Accounting Division.

7. Licensed Projects Accounting

Chairman, H. W. Boozer, Georgia Power Company. This is not a joint committee, since its subject matter affects electric utilities only. Its chief concern is with (a) the determination of "excess earnings" after the first twenty years of operation of hydro-electric projects licensed under the Federal Water Power Act, and the Federal Power Act; and (b) the meaning, from an accounting point of view, of "net investment" in plant, as the term is used in Section 3(13) of the Federal Power Act, a "clarification" of which was proposed by the staff of the Federal Power Commission in Docket R-105. Hearings in this case were suspended last year by the Commission without final determination of the questions at issue.

8. Protection and Preservation of Records

Chairman, P. H. Gadsden, Philadelphia Electric Company. This committee will continue as opportunity offers to press for further liberalization in requirements governing the destruction of non-current records, and the use of microfilm copies. It will also survey and report on recent developments in the use of microfilm by particular companies.

9. Distribution and Capitalization of Overhead Costs

Chairman, J. P. O'Brien, The Cincinnati Gas & Electric Company. The committee will study more specifically

J. A. RYAN

Chairman of the Plant Accounting and Records Committee—Inventory Engineer, Consolidated Edison Co. of New York, Inc., New York, N. Y.

the following: (a) interest during construction—the economic justification for treating it as a capital cost, the bases for determining the amount properly capitalized, ratio of capitalized interest to total construction charges for a given period; (b) pension costs—why capitalized and how much; (c) administrative and general expenses — apportionment between departments in combination companies, determination of amounts to be capitalized; (d) analysis of total overhead capitalized and ratio thereof to total construction costs.

10. Budgeting and Forecasting

Chairman, R. O. Linville, Kansas City Power & Light Company. This committee will study and report on techniques used by various companies in the preparation and use of operating, construction, and cash budgets.

J. R. WEGER

Chairman of the Taxation Accounting Committee — Supervisor, Tax Accounting, Consolidated Gas Electric Light & Power Co., Baltimore, Md.

Plant Accounting and Records Committee

The Plant Accounting and Records Committee under the chairmanship of J. A. RYAN, Consolidated Edison Company of New York, Inc., with F. A. DRAPALIK, Union Electric Company of Missouri, as vice-chairman, has undertaken the following projects.

The assignment of individuals to different projects has not yet been fully determined. The committee is shaping its work toward reports which will be presented for group discussion at the next joint accounting conference, scheduled for April in Detroit. These reports will deal with:

1. Methods used by a selected company in collecting costs and distributing them to property units in the mass property accounts. The discussion will cover:
   (a) Type of order—annual, specific, etc.
   (b) Primary or secondary accounting—i.e., are accounts to be charged by field forces indicated on the detailed layout or is the accounting done by estimate in the office.
   (c) Procedure used to clear Construction Work in Progress—frequency of clearance, etc.
   (d) Methods used in allocating costs to property units.
2. Methods of pricing inside plant. Are companies pricing continuous property record units, retirement units, or a combination of both in some circumstances? Unit cost development by trade classification. Developing prices for retirement units at time of retirement when C.P.R. units are priced in total, showing components of construction costs, e.g., labor, material, etc., in final priced records.
3. Budget control of construction costs in a period of rapidly rising prices. Have allowed tolerances between actual and estimated costs had to be widened? Have any new safeguards against inefficiency been made necessary? Is close correlation with index numbers generally accepted as a satisfactory explanation of differences between budget estimates and actual results?

The Plant Accounting and Records Committee also expects to arrange for a guest speaker at the joint accounting conference to discuss the relation between

(*Continued on page 378*)

The Utilities' Part in the Mobile Radio Hearings

E. D. Glatzel, Detroit Edison Co., and G. H. Underhill, Central Hudson Gas & Electric Corp., present National Committee for Utilities' Radio Statements before F.C.C.

THE hearings on mobile radio frequencies were held before the Federal Communications Commission beginning on October 6 and extending through October 15. The purpose of the sessions was to receive comments and statements on certain proposals of the Commission affecting nearly all services utilizing mobile radio.

As far as the utilities were concerned, the FCC proposals were of interest primarily from two standpoints.

a. The adequacy of the frequencies, in so far as their number and location in the spectrum was concerned, which the Commission proposed to allocate for utility use.

b. The proposed reclassification of the Utility Radio Service as a subgroup of a proposed industrial Radio Service.

Members of the National Committee for Utilities Radio appeared before the Commission on October 11 and presented the Committee's comments on these proposals.

Classification of Service

E. D. Glatzel presented the statement covering the Committee's views on classification of service. His statement was supported by further statements from executives representing electric, gas and water utilities from all parts of the country. These are listed here: E. M. Borger, President, Peoples Natural Gas Co., G. F. B. Owens, Ass't Vice President, Brooklyn Union Gas Co., R. H. Ulrich, Vice President, Southern Natural Gas Co., C. F. DeMey, Vice President, Columbia Engineering Corp., L. I. Bateman, representing Mayor of Los Angeles, American Public Power Ass'n, and American Water Works Association, H. Turner, Vice President, Ohio Power Co., Robert H. Fite, Vice President, Florida Power & Light Co., J. F. Davenport, Ass't Vice President, Southern California Edison Co., M. F. Gill, President, Kansas Gas & Electric Co., J. L. Bates, Vice President, Central Power & Light Co., C. A. Leland, President, Iowa Power & Light Co., Edwin S. Bundy, Vice President, Buffalo-Niagara Electric Corp., J. T. Ward, Vice President, Boston Edison Co., C. E. Oakes, President, Pennsylvania Power & Light Co., Claude Wickard, REA Administrator, and Clyde T. Ellis, Executive Manager, National Rural Electric Cooperative Association.

Channel Requirements

G. H. Underhill presented the Committee's views on channel requirements. This statement was based on a voluminous and comprehensive report of the Committee entitled "Mobile-Radio Requirements of the Electric, Gas, Water, & Steam Utilities of the U.S.A." It was prepared by a Subcommittee of the National Committee consisting of the following members: G. H. Underhill, Central Hudson Gas and Electric Corp., Chairman, E. D. Glatzel, Detroit Edison Co., J. C. McKinley, West Penn Power Co., M. K. Patterson, Minneapolis Gas Light Co., and W. C. Phillips, New England Power Service Co.

The report was based upon replies to questionnaires, engineering studies of propagation, selectivity, etc., and preparation of detail maps and charts listing present and future utility users of mobile radio in selected areas.

It is expected that the Commission will issue its decision on the matter of classification of service shortly after the first of the year. It is believed that additional hearings may be required before final decisions can be made on frequency allocations.

Extracts from Statement by E. D. Glatzel on Classification of Service

In presenting arguments of the National Committee for Utilities Radio on the matter of the Commission's proposal to establish a Power Radio Service as a subpart of the Industrial Radio Service, I wish to discuss the matter of ***classification***. This matter is very important to us. We foresee in the future a tremendous expansion in the use of radio for land mobile communications. If the Commission is not able to find a source of additional channels to take care of this expansion, or if technological developments do not keep pace with this expansion to make it possible to operate a substantially larger number of stations on a given number of channels, then we foresee the possibility of the number of stations per channel increasing to a point where service will be degraded. At this point, radio begins to lose its value to the user and to the public.

We do *not* believe that the Commission will permit this to happen in services where public safety and welfare are an important factor. In solving this problem we *do* believe that the Commission may find it necessary to establish some system of priority in the assignment of channels.

Priorities for Public Safety

In determining any such priority, we believe that the Commission will have to consider two questions:

First: If an applicant desires to utilize radio in his activity, how vital is that activity to the public safety, and welfare?

Second: How necessary is radio communication to the conduct of that activity?

Without a doubt the highest priority must be assigned to the services which are responsible for public safety.

Several representatives of the Electric, Gas and Water Utilities field from all parts of the country will be heard. They will emphasize the importance to the public of the services which are rendered by those utilities. They will, I am sure, verify the fact that mobile radio is a valuable tool and that the utilities use it to safeguard life and property and to

reduce the number and shorten the duration of occurrences which jeopardize the welfare of large numbers of individual citizens. These occurrences may arise in the operation of these utility systems, but more frequently they are the result of storms and adverse conditions beyond the control of the utility operator.

Considering that there are over 4000 electric power utilities; over 1200 gas utilities; and over 13,000 water utilities, it will be clear that the situations which they describe exist or may occur in nearly every city, town and village and in most rural areas throughout the United States. Over 120 million Americans utilize directly, and are dependent upon, the services that one or more of these utilities provide. It will be shown that disruption of the supply of any of these services has an immediate and direct effect upon the *public safety* and *welfare*. For this and other reasons, utilities are usually given the right of eminent domain, and granted franchise to occupy public property. If not operated by government agencies, they are normally regulated by them as to service areas, standards of service, and rates. A further indication of the importance of the services rendered by these public utilities is the fact that strikes by public utility employees, which might affect the continuity of these services, are outlawed in many states, and in others are subject to severe restrictions. These characteristics are unique to the public utilities and result in their being charged with responsibilities to the public second only to those of governmental agencies.

Utilities' Service and the Public Welfare

When something goes wrong with any one of the essential utility services, the average citizen, whose safety and welfare is affected, expects prompt and effective action.

The utilities dispatch by radio an impressive number of orders for the investigation and correction of conditions actually or potentially hazardous to persons and property.

Such activities, performed by an organization charged with public responsibility and duty, should be recognized for their contribution to public safety.

The Public Safety Services (as defined by the Commission) have no monopoly on public safety activities.

The public is also served by a multitude of other enterprises of an entirely different character. These industries, as they are commonly called, do not have the same direct relationship to the public safety and welfare that public utilities have. Their products need not be delivered instantly and continuously around the clock. Any interruption in their function of producing and distributing goods or rendering services does not directly affect the safety, or even the welfare of the general public, unless the interruption is of wide extent and of long duration. In fact, most of these industries are themselves dependent on the service rendered by the utilities for their operation, and interruptions to the utility services usually result in the disruption of their operation. The operation of these non-utility industries is seldom directly regulated by government agencies, and in general they are not vested with the right of eminent domain or of franchise, consequently they do not have the obligations to the public which goes with such rights. Only in exceptional cases is the public exposed to hazards involved in their operation. Considering these factors it is clear that in most instances their use of radio is primarily for private convenience and the protection of their employees, plant, or products, as distinct from the person and property of the general public.

Non-Utility Services

Considering these wide differences in the basic character of the public utilities and industries in general, and their relationship to the public interest, convenience and safety, it is difficult to understand the Commission's reasons for proposing that the two be classified together in the Industrial Radio Services. This classification—in the proposal—includes services, most of which, as far as we know, have neither claimed nor received recognition, either as an emergency or as a public safety service. In general, we do not believe that the nature of operations of these non-utility services warrants such recognition.

There are serious difficulties ahead *unless* a clear and unmistakable distinction is drawn between (1) mobile radio communication for the protection of the citizen against hazards inherent in our modern system of living, as distinct from (2) mobile radio communication for the convenience of the customer and the private profit of the vendor.

As the Committee views it, the only sound basis for classifying radio services is in accordance with the public convenience, interest and necessity. This contention is borne out by Section 303 of the Communications Act of 1934, as amended, which states that "The Commission from time to time, and as public convenience, interest or necessity requires *shall* . . . (a) Classify radio stations." Therefore, the relative contribution to the *safety* and *welfare* of the public is a logical criterion on which to base classification. As between two activities making completely incomparable contributions to public safety and welfare, there may be great similarity in radio *needs, application* and *use*. These factors, however, do not form a logical and sound basis for classification.

Considering all these factors, the Committee believes that the Commission's proposals to reclassify the land-mobile services if used, or intended to be used as an indication of relative public need for such services, are, as regards the power utility service; contrary to the weight of evidence; at variance with the public need and welfare; and detrimental to the future development of the Power Utility Radio Service. We therefore object to the proposed reclassification of the Power Utility Service as a Subgroup of the Industrial Radio Service. We request that the Commission reconsider its proposed reclassification of the Power Utilities along with the reclassifications proposed for the other services, and classify the Power Utilities in a category of service which clearly indicates that in so far as public safety and welfare is concerned, *this service is second only to the Police and Fire Services.*

Administrative Convenience Criteria

However, in making this objection, the Committee recognizes that possibly it is not the Commission's intention to associate classification with priority in the assignment of frequencies. We recognize that the proposed new system of classification may have been advanced purely on the basis of internal administrative convenience. If administrative convenience is the broad motive and the Commission has no thought or intention of utilizing the proposed classifications now or in the future as a basis for frequency allocation priorities, the Committee is willing to withdraw its objection to the proposed reclassification, provided that the Commission modifies the proposed rules for each of the four services so that it is clearly indicated that the classifications are purely for administrative convenience.

Extracts from Statement by G. H. Underhill on Channel Requirements

I—Introduction

In June, 1948, the Federal Communications Commission issued a series of frequency reallocation proposals which would make available to the "Power Radio Service" additional frequencies for fixed and mobile use in the 0-300 mc. portion of the spectrum.

In order to establish a sound basis for constructive criticism of these proposals the National Committee For Utilities Radio conducted a comprehensive review of the national situation. This report presents the results of that study which has determined, within narrow limits, the radio-frequency channel requirements of the electric, gas, water, and steam utilities of the U. S. A. during the next few years.

The data which form the basis of the study were collected through individual inquiries which were sent to more than 1500 present and prospective radio users representing roughly 20 per cent of the possible users. The information contained in the 1100 odd replies received was transferred to IBM cards and machine analyzed. The results form the basis for Table "B" (Fig. 1) which summarizes the Committee's estimate of the 1951 situation and compares it with the 1944 and 1948 conditions.

TABLE B - GROWTH OF UTILITY RADIO SERVICE

	1944 Actual	1948 Actual	1951 Est.	Increase
1-5 mc				
Systems	21	27	25	- 2
Base Stations	57	49	35	-14
Total Transmitters	149	200	150	-50
25-50 mc				
Systems	43	312	550	238
Base Stations	99	830	2,000	1,170
Total Transmitters	698	14,241	25,000	10,759
72-76 mc				
Systems	0	16	15*	- 1
Base Stations	0	50	35*	- 15
Total Transmitters	0	812	450*	-362
152-162 mc				
Systems	4	47	335	288
Base Stations	10	85	765	680
Total Transmitters	10	1,274	8,550	7,276
Total				
Systems	78	402	925	523
Base Stations	166	1,014	2,835	1,821
Total Transmitters	857	16,527	34,150	17,623
Licensees (eliminating duplications)	56	365	850	485

NOTE: * Exclusive of Fixed Service Installations

Fig. 1—Table of the Growth of Utility Radio Service, 1944, 1948 and an Estimate for 1951

IV—Engineering and Operating Limitations

The Commission's proposals would essentially limit mobile system operations to the 30-50 mc. and the 152-162 mc. bands.

In setting up a technical basis for determining channel requirements in each of these bands, it was recognized that the principal factor which controls the geographic separation of systems is the interference produced at a base receiver by a neighboring base transmitter. The engineering limitations finally adopted consequently relate only to base station conditions and make no attempt to recognize the unlimited number of field conditions encountered by mobile units.

In brief, they provide a 2-to-1 protection ratio for a one microvolt mobile signal against the signal produced by a base transmitter radiating 250 watts from an antenna having an effective height of 100 ft; both signals being transmitted over smooth earth and appearing at the terminals of a receiver of modern design operating with an antenna of 100 ft effective height. For the 152-162 mc band only, an antenna gain of 5DB was assumed.

Using these factors and carrying through attenuation calculations in accordance with accepted methods, the following results were obtained and adopted as the *minimum, normal* geographic spacing required between base stations of systems operating on 40 kc. channels in the 30-50 mc. band and on 60 kc. channels in the 152-162 mc. band.

	30-50 mc.	152-162 mc.
Co-channel operation	100 miles	75 miles
Adjacent channel operation	50 "	35 "
Alternate channel operation	10 "	5 "

From a practical viewpoint, these are average values, and they include no margin for off-frequency operation up to the limits of permissible tolerances, for variations in antenna heights, for terrain factors; nor do they recognize that conditions will be encountered where the shape of the operating territory will place mobile units in positions where interference will be experienced.

Before these technical findings could be applied to actual situations, it was necessary to reach a conclusion in the matter of channel sharing and the extent to which it can be practiced without resulting in a degrading of the service. The following principles as applied to the Utility Radio Service are considered to be reasonable and sound:

1. *Utility licensees are entitled to the use of channels which are neither occupied by nor subject to interference from other local users.* This does not imply that local sharing between utility licensees on a voluntary basis should not be encouraged in those cases where the small size of the installation or the need for mutual assistance makes local sharing desirable and practical. It does mean that such sharing should not be mandatory. If a channel is in a band which is subject to skip interference, its assignment to distant users should be geographically controlled so as to minimize such interference.

2. *Channels which need to be repeatedly occupied by utility licensees located throughout all the more congested sections of the country should be allocated to the utility service on an exclusive basis.*

3. *Any channel the need for which in the utility service is confined to a few highly congested areas should be allocated on a*

shared basis with other services, provided the channel is made exclusive to the utility service within such areas. This reservation is essential if the development of the Service is to be intelligently planned and disputes over prior occupancy or superior rights avoided.

These principles have been adhered to in this study and ANY DEVIATION FROM THEM WILL NECESSITATE A RE-DETERMINATION OF THE CHANNEL REQUIREMENTS.

V—Channel Requirements

a. 30-50 and 152-162 mc bands

The major need for channels is in the land-mobile service and the principal mobile service bands—30/50 and 152/162 mc—have accordingly been examined in detail and independently of collateral need, such as point-to-point, dispatch and low-power service.

In the 30-50 mc band, the greatest density of transmitters will occur in a belt some 500 miles wide extending along the Canadian border from the Atlantic Ocean to the Mississippi River.

In the 152-162 mc band, heavy concentrations appear in the vicinity of all cities having a population of more than 600,000.

Consideration of these data led to the selection of two regions for detailed analysis and of several additional areas for less complete study. New England was selected as one of the two major regions because of its geographic compactness and resultant high transmitter density. The Great Lakes region was the second major area chosen because it contains the largest number of systems and transmitters of any area. Supplemental studies were made of the Middle-Atlantic and the Texas-Louisiana regions as a check on the 30-50 mc results, and of the areas surrounding several major cities as a check on the 152-162 mc results.

The technique used in each case was as follows:

1. The base stations of all systems expected to be in operation in 1951 were plotted on two large scale maps of the region — one showing all 30-50 mc stations, the other all 152-162 mc stations. These maps show the ownership and status (existing or proposed) of each station. Exhibit F (Fig. 2), covering the 30-50 mc band for the Great Lakes regions is included as illustrative of the nature of these exhibits.

2. Using the basic minimum separations developed as described in Section IV, a determination was made, *for each base station,* to show which other base stations could operate co-channel with it, which must be separated by at least one channel and which must be separated by at least two channels, etc. This phase of the study involved a large number of measurements on each map. Since a practical, rather than a rigid theoretical answer was desired, these measurements were either made or reviewed in detail by an engineer who was intimately familiar with the region. This man decided from personal knowledge or from reliable, first-hand information whether the theoretical separation must be increased to allow for an abnormally high transmitter elevation, for frequent, unusual, and prolonged tropospheric effects, etc., or whether intervening mountain ranges or other unusual circumstances would permit a reduction in the separation indicated. Where changes were indicated, they

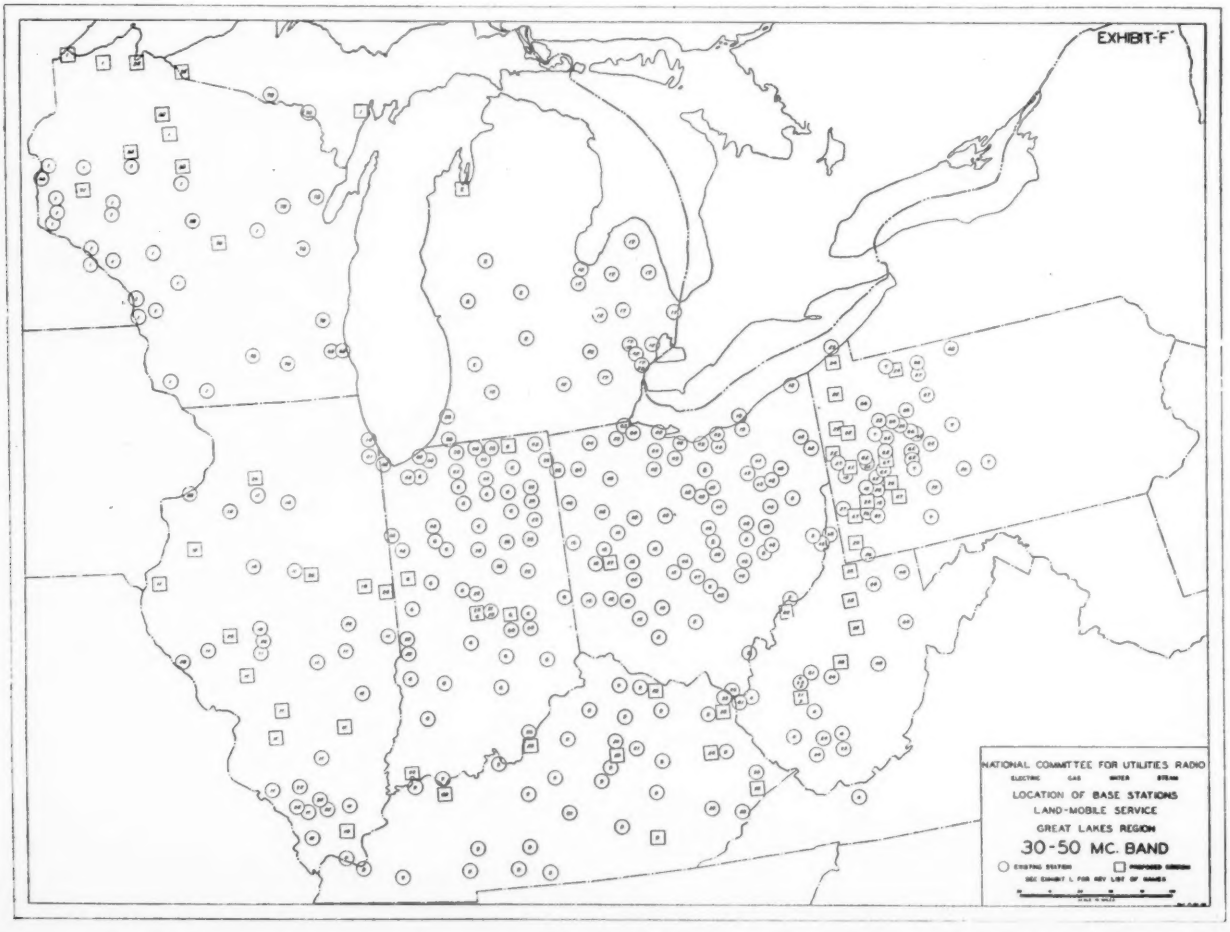


Fig. 2—Density Map of Base Stations in the 30-50 Mc Band for All Utilities in the Great Lakes Region

were made and the resulting channel separation required between the two systems being considered was then entered in cross-tabulations showing all systems. Exhibit "B" (Fig. 3), of the report, covering the 30-50 mc band for New England illustrates the cross-tabulations employed.

The results of this step thus reflect the experienced judgment of a competent and informed engineer who has been guided by the theoretical studies and standardized set of basic conditions set forth above.

3. From this tabulation of the channel separation required between any two systems in the region, a "channel occupancy schedule" was developed which indicates the number of channels required to accommodate all systems. The development of this schedule was a cut-and-try process with the obvious objective of utilizing the minimum possible number of channels.

As a result of these four studies, it was found that the base stations of those systems included in the study require the following number of consecutive channels, of 40 and 60 kc band widths respectively, in each band in order to effectively function under the reasonable standards of engineering and operation set forth in Section IV.

	30-50 Mc. Band	152-162 Mc. Band
New England Region ...	28 channels	31 channels
Great Lakes Region ...	28 channels	11 channels

Considering these data and other factors such as the need for mobile-only channels, it is concluded that *36 channels in the 30-50 mc band and 20 channels in the 152-162 mc band are the minimum exclusive allocations which will accommodate the needs of the service for the next few years.*

The studies indicate that requirements in the 30-50 mc band are remarkably uniform in the more populated sections of the country and that a comparatively small number of shared channels will be needed to accommodate congested areas. On the other hand, requirements in the 152-162 mc band appear to vary considerably between locations and the allocation of 20 exclusive channels will not meet the needs of the Boston, New York, Philadelphia and Los Angeles areas, nor possibly of other areas which have not been studied. These are localized cases, however, and as previously pointed out, it is unrealistic to establish national requirements on the basis of a few exceptional cases, *provided such situations are protected by the exclusive allocation on a restricted geographic basis of an adequate number of "shared" channels.*

If these conditions with regard to shared channels and the interdependence of the two frequency bands are not met, the channel requirements will be radically changed.

b. Other Frequency Bands

Channel requirements in the two remaining bands have been determined on a judgment basis.

c. Special Applications

On the basis of general knowledge and

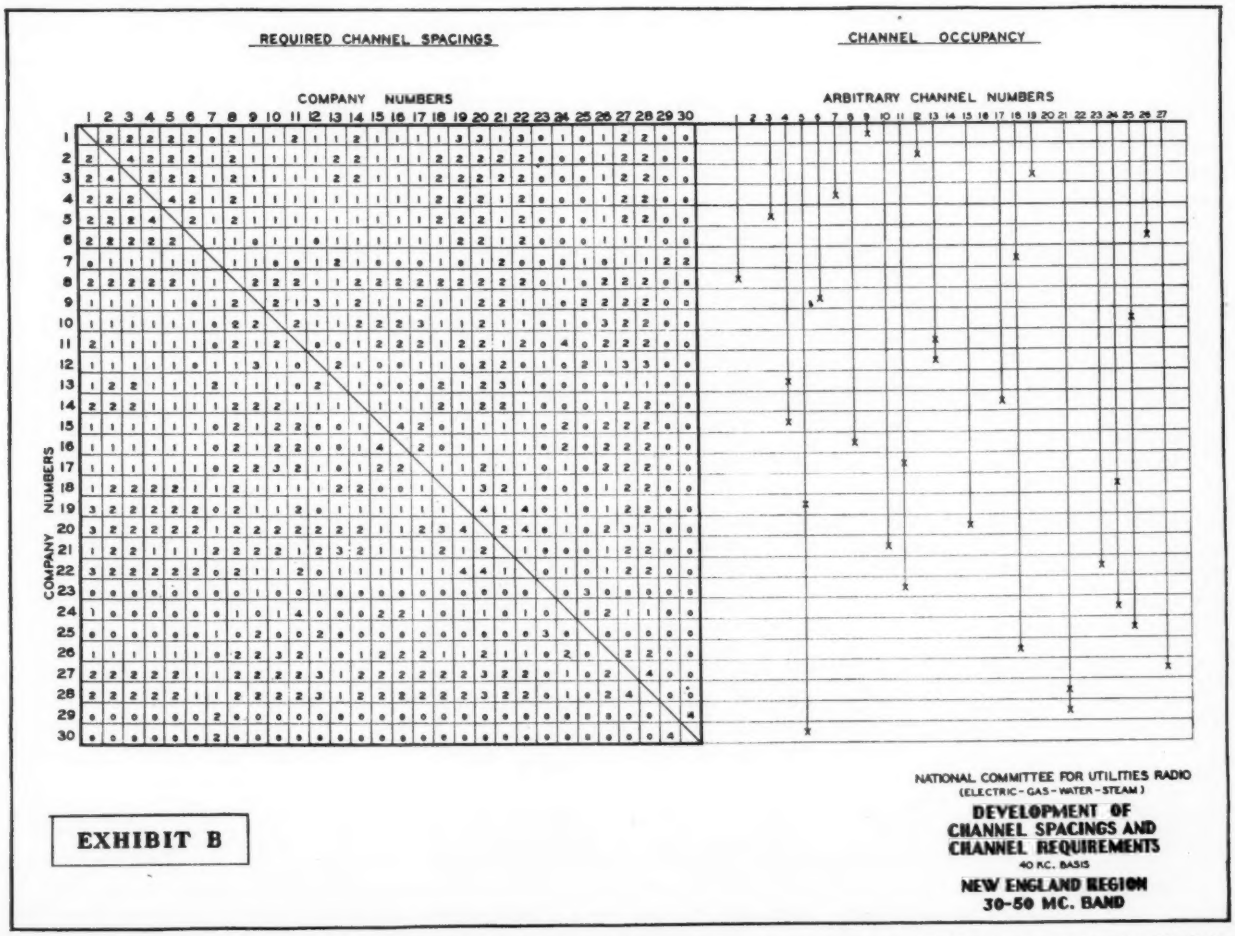


Fig. 3—Chart of the Development of Channel Spacings and Channel Requirements of the 30-50 Mc Band for All Utilities in the New England Region

past experience, it is believed that the operations of those relatively few systems which utilize 2 frequency systems would be adequately provided for if three, exclusive, mobile-only frequencies were provided in the 30-50 mc band and two such frequencies in the 152-162 mc band. Channels in this number have been included in the total requirements for these bands.

exclusively to "Power" be interchanged with 13, 20-kc channels in the 49 mc block to be allocated to "Special Industrial"; Secondly, that those new systems which can utilize 152-162 mc frequencies will not be forced to operate in the 30-50 mc band because sufficient 152-162 mc channels are not provided.

VI—Conclusions

CHANNEL ALLOCATIONS AND REQUIREMENTS

Band	Allocations				Requirements	
	Existing		FCC Proposal			
	Exc'l	Shr'd	Exc'l	Shr'd	Exc'l	Shr'd
1- 5 mc.	2	2	0	7	0	6
25- 30 mc.*	0	0	6½	2½	0	0
30- 40 mc.	0	11	11	9†		
42- 44 mc.	0	0	0	2†	36	12
44- 50 mc.*	0	0	19½	18½		
72- 76 mc.	0	6	0	18	0	18
152-162 mc.	0	6	6	11‡	20	16
Total	2	25	43	68	56	52

NOTES:
* These channels assumed to be 40 kc wide.
† Omitting 4 channels restricted to Dispatch Service, but including 2 channels restricted to Low Power.
‡ Omitting 8 channels restricted to Dispatch Service.

As has been shown, *these requirements are firm, substantiated estimates* based upon an analysis of individual reports from more than 1000 present and prospective licensees and upon comprehensive, factual, engineering studies of several, typical, congested areas. They include limited provisions for: "mobile-only" and "low-power" channels, (2) new systems not included in the survey, and (3) expansion of large present systems beyond the loading limit of a single channel per band.

The requirements are accordingly realistic and conservative, and expansion beyond 1951 must be provided for either by technical improvements in equipment design or by further frequency reallocations, as *there is no margin for such expansion in the estimates.*

Based upon these requirements, the following conclusions with respect to the frequency allocations proposed by the Commission have been reached:

1. They meet the foreseeable needs of the Utilities for frequencies below 30 mc.
2. They will meet the short term needs of the Utilities for frequencies between 30 and 50 mc only if two conditions are met: First, that 13, 20 kc channels in the 27 mc block proposed to be allocated
3. They will meet the foreseeable needs of those Utilities which operate outside areas where television channels 4 or 5 have been assigned, for fixed frequencies between 72 and 76 mc if no sharing by Public Safety Services is permitted on any of the channels proposed for allocation to the Industrial Services.
4. They do not meet, *by a wide margin*, the *present* needs of the Utilities for frequencies in the 152-162 mc band. Additional channels to the extent of 14 exclusive and 5 shared are required to accommodate the anticipated short term growth in this band. If these are not provided in the final allocation plan, the Service faces a most difficult sharing problem and a definite degrading in both the 152-162 and the 30-50 mc band. This study has presented facts which make such a development a certainty, not a possibility. A public safety service should not be permitted to become involved in such a situation.

If the proposed allocations and channel requirements be translated into terms of equivalent spectrum space (shared channel space being divided equally between the various sharing classifications and services) the results are:

Spectrum space proposed—2444 Kc.
Spectrum space required—3018 Kc.

It is significant that THE TOTAL SPECTRUM SPACE REQUIRED TO ACCOMMODATE A RADIO SERVICE WHICH AFFECTS THE SAFETY, HEALTH AND WELFARE OF MORE THAN ONE HUNDRED MILLION PEOPLE, IS BUT THE EQUIVALENT OF ONE-HALF OF ONE TELEVISION CHANNEL OR ONE PER CENT OF THE ENTIRE SPECTRUM BELOW 300 MC.

EEI General, Engineering and Accounting Committees Organized to Meet Wide Demands of Industry's Activities

(*Continued from page 372*)

depreciation accounting and plant accounting and property records.

Taxation Accounting Committee

The Taxation Accounting Committee will be headed this year by J. R. WEGER, Consolidated Gas Electric Light and Power Company of Baltimore, and vice-chairman, C. J. TRUDEAU, Wisconsin Electric Power Company. Its meetings, which are always exceptionally well attended and lively, are primarily devoted to discussions of the highly technical phases of tax accounting and tax determination, particularly the rulings and decisions relating to the administration of the federal income tax law, which are becoming a vast and complicated volume of law and regulations only to be satisfactorily dealt with by specialists. Their interchange of views and experiences is thought by most members of the committee to be its principal function and main value to them. However, from time to time it releases for distribution to member companies papers and reports on tax questions thought to be of more than technical interest.

The Taxation Committee plans three meetings during the year jointly with the corresponding AGA committee for members only; the first in February at Atlanta. It will also hold one or more meetings, open to anyone interested, in connection with the joint accounting conference in April and possibly during the October convention of the AGA.

Electrical Testing Features Involved In Starting the New O. H. Hutchings Generating Station of the Dayton Power & Light Company

By H. E. Deardorff

Vice President, Dayton Power & Light Company

An address before the Electrical Equipment Committee Meeting, EEI, Pittsburgh, Pa., October 14, 1948

THE following is a review of the testing program which was set up for the purpose of checking the electrical installations at the new O. H. Hutchings Generating Station of the Dayton Power and Light Company, preparatory to placing it in service. The time element involved in placing this station in service was of paramount importance and influenced all factors in connection therewith since the Dayton Power and Light Company's system was deficient in generating capacity and was depending upon neighboring utilities for assistance in carrying peak loads. This assistance was not of too firm a character due to capacity shortages existing in the adjacent area and consequently new capacity was urgently required.

The O. H. Hutchings Station is a completely new development located approximately 10 miles south of the City of Dayton and was installed over a period of time slightly exceeding 19 months. Ground was broken in November, 1946, and the first turbine generator was placed in commercial service in July, 1948.

Initial Site Development

The initial development program at the O. H. Hutchings site has included widening and deepening of the Great Miami River which flows adjacent to the site, construction of a low head dam to provide an impounding basin for condensing water, construction of levees on both sides of the river as a flood protection measure, and the construction of an intake bay and 1700-ft discharge canal. A cold water system was installed with three deep wells connected in a loop system and to an elevated storage tank of 200,000-gallon capacity. Coal handling equipment was installed consisting of a rotary car dumper of 100 tons capacity and a three-section belt conveyor system. The main building foundation and substructure was completed for five generating units. The building superstructure was completed for two 60,000-kw turbine generators and two 550,000 lb-per-hour, 1300-psi, 950F pulverized fuel fired boilers. An associated three-story service building for offices and shops used in connection with the station was also erected. A 69-kv transmission substation was installed for the purpose of controlling the various transmission lines radiating from this point.

The placing in service of the first unit in this plant within a 19-month construction period constitutes somewhat of an achievement when one considers the trying situations which develop today due to material and labor supply and a host of other delaying factors. Due to the great need for reducing the time element to an absolute minimum, the testing program which was designed to provide the electrical installation with the necessary tests to insure safe operation of the station should be considered somewhat of a minimum program which could be tolerated in view of the extenuating circumstances mentioned and a consideration of the various risks involved in placing different types of equipment in service.

The following review considers the various elements of testing in a topical fashion.

Generator and Exciter

The first generator which is a 60,000-kw, 85 per cent power factor, 3600-rpm,

Aerial view of the O. H. Hutchings Generating Station of the Dayton Power and Light Company located on the west bank of the Great Miami River, 10 miles south of Dayton, Ohio, showing 69-kv outdoor substation. Intake bay and discharge canal are in the foreground

12,500-v, hydrogen-cooled machine, is equipped with a separate motor generator exciter. The generator stator was meggered with a 2500-v Megger and the rotor was meggered with a 500-v Megger. The governor motor current was measured to determine the adequacy of control switch contacts since a number of cases of failure at this point have been experienced in the past. The windings of the motor and generator on the exciter were meggered with a 500-v Megger and all connections and wiring were verified and checked for tightness. It was necessary to flash the fields on the d-c exciter in order to force it to build up in potential.

12-kv Buses

Strictly speaking, there are no 12-kv buses in this station—merely a phase isolated, metallically enclosed bus structure extending from the generator terminals through the walls of the building to the main power transformers. These buses consist of hollow rectangular copper conductors supported by insulators and completely enclosed within circular metallic coverings. These buses were given a 25-kv, 60-cycle, high-potential test from phase to ground. All joints were triple tested for tightness by the contractor's electricians, the Test Department and the station electricians. Some of the through-type current transformers were in place when the bus was tested and hence were included in the high potential test. Other through-type current transformers were checked in the laboratory for ratio and phase angle and a 2300-v, high-potential test was impressed upon the secondaries.

Power Transformers—Main and Auxiliary

The main power transformers consist of 3 single-phase, 21,667-kva, 12/69-kv, oil-insulated, self-cooled units with provision for supplementary fans. These transformers were tested at the factory in the presence of Ebasco representatives for the Company. In addition to all standard tests they were also given an impulse test somewhat more severe than the ASA test, in accordance with Ebasco specifications. When received on the job, the bushings were Doble-tested outside of the tanks and visually inspected. Several damaged condensers were thus revealed and these were repaired in the field. Transformer windings were Doble tested with the bushings out of the cases and the complete assembly with bushings re-installed was then additionally Doble tested. Insulating oil was given a Doble test and a high-potential dielectric test. The ratios were checked with a Murray ratio bridge. High-potential facilities at 60 cycles were not available on the site since the Company's high-potential test truck has a top rating of 30 kv.

One 7500-kva, 3-phase, 69/2.3-kv, oil-insulated, self-cooled auxiliary transformer is utilized for "cold" starting up of the station or emergency service. This transformer was given somewhat the same treatment as the main power transformer. In this unit the 2.3 conductors leave the transformer by means of a pothead compartment in which cable terminations are by means of stress cones on Kerite cables.

Each generating unit will also have a 6,000-kva, 12/2.3-kv, 3-phase, oil-insulated, self-cooled auxiliary transformer directly connected to the 12-kv bus leaving the generator terminals for the purpose of supplying auxiliary power for the unit. This transformer is equipped with a 12-kv pothead compartment in which the single-conductor, lead-sheathed cables terminate in potheads immersed in oil, and a 2.3-kv pothead compartment in which the 2.3-kv Kerite single-conductor cables terminate in stress cones in air. This transformer was tested similarly to the other transformers with the exception of the pothead terminals. In this case the cables were meggered and phased out.

There are a number of 750-kva, 3-phase, 2300/440-v auxiliary power transformers supplying load centers. These transformers are of the dry type and were given a Megger test when connected to the 2300-v incoming cables. A ratio check was also made.

Auxiliary Power Boards

All motors above 150 hp are operated at 2300 volts. The various circuits to these motors and to 2300/440-v power distribution centers are supplied from 2300-v, metalclad auxiliary switchboards with truck-type air circuit breakers. This equipment was given a 5-kv high-potential test with all breakers in position and closed and all instrument transformers energized. All current and potential transformers were tested in place for ratio and phase angle. The secondaries were meggered. Relays were calibrated and tested in the laboratory. A representative number of air circuit breakers were checked by a factory man and the remainder were checked by the contractor's electricians assisted by the Test Department and station electricians. These breaker inspections included a check for contact alignment and condition; operating mechanism alignment, freedom of operation, lubrication, etc.; alignment of breaker trucks in cubicles and alignment of control circuit jacks; and in addition a measurement of the closing and tripping currents. All control and power wiring was verified and checked for tightness of connections.

On the 440-v auxiliary switchboards for various load centers the control and power wiring were verified and checked for tightness of connections. Instruments were shipped separately and were checked in the laboratory. The circuit breakers on these boards are of the air circuit breaker type with dual thermo-magnetic tripping devices on one group and oil film overcurrent time delay tripping on the other group. The various time delay settings for these breakers were made in accordance with calculation and the breakers were checked for operating condition.

Electrical Control Boards

All wiring was verified and connections checked for tightness. All indicating instruments measuring current, voltage, watts and vars, and synchroscopes, were checked in the laboratory. Recording instruments were likewise checked. All relays were tested and calibrated and final settings made in the laboratory in accordance with calculated values. Draw-out and flexi-test cases proved to be a great help in this work. After being returned to the board, all relays were test loaded and checked for tripping operation. No field calibration was made. Carrier current transmitters were set up and tuned in the field with a Link carrier oscillator. Sequential timing tests of carrier current relays are yet to be done by means of an oscillograph.

Boiler and Turbine Control Boards

All electric wiring was verified and tested for continuity and tightness. On these boards, instruments and meters were shipped in place and suffered considerable damage in transit. This consisted of movements jumping out of bearings, bent pointers, etc. The ammeters and wattmeters on these boards were all removed and checked in the laboratory but other instruments, such as speed and position indicators, were checked in place. The various L & N recorders were checked by a factory representative and

placed in service. Thermocouples for such recorders were not checked. Bailey meters were checked by a factory representative and placed in service. The turbine supervisory instrument was checked by the Test Department in a point to point method suggested by the manufacturer and all wiring was verified for correctness and tightness.

Control Wiring

No Megger tests were made on control wiring due to the time element involved and the fact that there were a great many people working on these circuits all at one time and the imposition of testing potentials would have constituted an undue hazard. All wiring was verified and checked for tightness of contacts. In connection with the installation and checking of the control cables, a scheme was developed which greatly simplified the process of installation and checking and really saved a great deal of time. This method consisted of placing a tag on each terminal block showing the color of the conductor which was to be attached to each terminal and designating the terminal notation. Control cables were then pulled and connected to the terminal blocks in accordance with the color scheme and terminal designation indicated on the tag. The Test Department next tested the continuity of only one conductor in each cable in order to verify the correctness of the cable continuity between its two terminal ends. The colors were then verified with the tag and the tightness of the connections checked. After this inspection, an additional tag was placed on each end of the cable giving its number, the location, the date checked and the name of the checker. A duplicate stub was then torn off and filed in the field office. These were used merely as a temporary record for the installation and greatly assisted in checking the progress of the work.

In this fashion many hours in installation and checking were saved, and in only one case was a failure noted and this came about due to a defect in one of the control cables which showed up at a later date. Standard color designations for functional uses were followed throughout. By means of this method, 300 control cables were installed and checked in a matter of approximately 5 days. In order to eliminate moisture grounds, the braid on each conductor was cut back ½ in. from the cable insulation. In those cases where moisture grounds have since shown up, it was a violation of this practice which was the contributing factor.

Power Wiring

All 2300-v cables were tested with a 1000-v Megger. All 440-v cables were not meggered due to lack of time. In all cases where 3 conductor cables were used, the conductors were color coded and standard phasing was employed.

Batteries and Chargers

A small carrier current battery was shipped upside down and numerous jars were broken, requiring factory replacement. One of the large control battery jars was broken and required replacement, and two others were upside down and partially dry. In one instance, a welder working in the battery area (which had not yet been walled off into a room by partitions), allowed sparks to drop on top of one cell causing an explosion in the jar, blowing off the top. This, in spite of the fact that he had been repeatedly warned about the hazard involved.

The battery chargers were checked for wiring verification, tightness of connections and in all instances required field flashing.

Auxiliary Motors

Auxiliary motors range in size from fractional to 2000 hp and are rated 110, 440 and 2300 volts, 3-phase. All 2300-v motors were meggered upon arrival. An attempt was made to utilize motor terminal designations to secure standardized phase connections and proper motor rotations, but in this respect, was only about 60 per cent successful. This was occasioned by the fact that some motors were unmarked and there was lack of uniformity of designation among manufacturers, which made it impossible to depend upon phase rotation. In connection with large motors, this becomes a costly proposition since high-voltage connections must be switched and in many cases the driven equipment must be disconnected before an initial turnover test is made. In this category are geared devices, deep-well pumps, coal mills, air heater fans, etc. Starting current tests with an oscillograph will be made later on the larger motors. In some instances, back-stop ammeter tests were made where tripping devices on circuit breakers would not hold during starting operations.

69 kv Substation

The transmission substation which controls the stepped-up voltage from the generator input and the various outgoing transmission lines, is equipped with 2500-mva, pneumatically operated, 1200-amp, 69-kv oil circuit breakers. The bushing current transformers in these breakers were tested in the field for ratio and phase angle and secondaries were meggered with a 500-v Megger. All breaker bushings were Doble tested in place. Insulating oil was Doble tested and given a high potential dielectric test. Closing and tripping currents were measured. No time-travel charts were made since these are available from factory records. A factory representative checked and tested a representative number of breakers for contact alignment; operating mechanism alignment, freedom and lubrication; and air tank reserve capacity and low-pressure lock out. The number of possible operations from a full tank to low-pressure lock out was determined as was the number of operations possible below the low-pressure lock out until the tank was refilled. The inspection was completed by the contractor's electricians assisted by the Test Department and the station electricians.

The 69-kv buses were given no high-potential or Doble test due to lack of time and the fact that a portion of the substation was energized early during the construction period. We feel that the buses should have been given a high-potential test but equipment was not readily available. All connections were given a triple check for tightness by the contractor's electricians, the Test Department and the station electricians. All disconnecting and grounding switches were checked for alignment and adjustment by the System Operating Department.

Transformer Testing

Instrument transformers which are oil insulated, were checked in the laboratory for ratio and phase angle and high-potential break-down. In addition, potential transformers were Doble tested and found unsatisfactory, requiring factory adjustment. The current transformers were not Doble tested since they became energized from one of the interconnections early in the construction period and time did not permit this test to be made. Coupling capacitors and wave traps were Doble tested. Wave traps were adjusted in place with a carrier oscillator. An attempt was made to check these on the ground but resulted in failure due to stray capacity changes which occurred when they were placed in the towers. All

lightning arresters were Doble tested. The 60-ohm neutral ground resistor was checked with a Kelvin bridge. Each section was separately checked and the overall resistance was also checked. No high potential test was given on this assembly.

Grounding

The grounding at the station site, consists of a grid made up of 500 lineal feet of interlocking steel piling under the river dam driven to a 25 ft depth; 3 deep-well casings ranging in depth from 135 ft to 150 ft; the sheet steel piling in the building substructure driven to a depth of 25 ft; numerous 20 ft-¾ in. copperweld ground rods driven in the 69-kv substation; and the transmission tower footings. All of these elements are interconnected with 500-Mcm copper conductors. Each element in the ground grid was given a separate ground resistance test using a ground Megger. In testing the ground grid, all connections were checked for tightness.

General

After various electrical installations were completed, operational tests were made wherever possible before the actual starting of the equipment. In a great many cases, these were simulated tests which were designed to set up conditions approaching actual operation conditions as nearly as possible. In other cases, actual operational tests were made. In connection with the test program, the minimum current or voltage pick up of various contactors, relay armatures, etc. was measured. This test provided an excellent check on their condition since faulty assembly, workmanship, mechanical damage, etc., is shown up in this manner and can be corrected before being placed in service. Automatic throwover features were tested by means of a simulated test with auxiliary breakers placed in the test position. Live tests on this feature were made after the equipment was placed in operation.

Practically all indicating lamps that were shipped in place on the control boards had broken filaments and required replacement.

The tripping settings on breakers supplying auxiliary motors were classified into three groups. The first included all 2300-v motors which are equipped with individual air circuit breakers and induction long time delay overcurrent relays. These were set for tripping at 125 to 150 per cent full-load motor rating with instantaneous tripping attachments set at 8 times motor rating. It may be necessary to adjust some of these settings after oscillograph records are obtained. Group 2 included all the 440-v motors equipped with dual thermo-magnetic tripping devices and air circuit breakers. In these cases, time current curves were compared to motor insulation damage curves and dial settings for overload protection selected to give values below the damage point. Instantaneous tripping is 12 times breaker rating which means that the selections must be closely coordinated with the breaker application. The third class included all the 440-v air circuit breakers supplying circuits to the various 440-v load centers. These breakers have oil film time delay tripping with instantaneous trip at 12 times breaker setting. It was necessary to coordinate the settings of these breakers with the numerous individual motor breakers which were supplied through the load centers.

During the test period, temporary telephone connections were installed throughout the areas containing equipment to be tested. The use of this facility greatly expedited the testing work by offering rapid communication.

An amazing lack of responsibility on the part of the contractors' workmen employed on the project was experienced. Almost unbelievable acts were committed by workmen which greatly jeopardized equipment and property and required eternal vigilance on the part of those in charge to police areas after the workers left their jobs for the day. Electricians would leave oil circuit breaker operating cubicles standing wide open exposed to the weather in the outdoor substations. The ever-present fire-throwing welders would toss pieces of welding rods in all directions regardless of where they might fall, and in numerous instances they could have readily fallen into motors in operation and damaged windings. Doors on power centers were removed for refinishing leaving the contents exposed to glass wool and fibers from pipe covering. Sweeping operations were performed without dust inhibitor being used, resulting in clouds of dust being raised around relays and control equipment. In another instance, painters working on the generator sprayed filler and grinding compound on the open collector ring end, and so on ad infinitum.

Since the plant has been placed in operation in July of this year, there have been seven forced outages. Four of these were of electrical origin, one of which was due to incorrectly connected differential relays protecting the generator, and the other three due to electricians becoming involved in energized control circuits and tripping auxiliary equipment. One outage was attributed to operational procedure in handling the pulverized coal burners which caused the fire to be blown out. Two additional outages were caused by economizer tube leaks.

When everything in general is considered, however, the conclusion is reached that a fine job was accomplished in a very limited period of time and under great difficulties, many of which have been reported in the foregoing review. The plant was placed in service in a sort of open air atmosphere with many building walls, windows and partitions missing, and with numerous operational hazards to life and limb due to holes in the floor, lack of stairs, temporary ladders and platforms, etc.

In spite of all these difficulties which now seem to be just about over, the plant is settling down to its daily task of grinding out kilowatthours, in anticipation of the assistance of No. 2 unit which is expected to be available for service about March, 1949.

New Planned Lighting Promotional Aids Now Available

SIX new promotional and educational aids have just been completed to supplement the Planned Lighting Program of the electrical industry, and are now available from the Edison Electric Institute and Better Light Better Sight Bureau, joint sponsors of the program.

Prepared at the request of electric utility companies now engaged in promotion of Planned Lighting, the new materials consist of a customer booklet covering ideas for modernization of existing home lighting; a folder with suggestions for better light for children's study areas in the home; a folder with lighting ideas for customers now planning to build or remodel homes, and a series of three mailing pieces on Planned Lighting for food stores.

Sample copies of the above materials are available to electric utility companies upon request to the Edison Electric Institute, 420 Lexington Ave., New York 17, N. Y.

Elimination of Gaskets on Underground Submersible Transformers

By C. P. Xenis

Consolidated Edison Company of New York, Inc.

A paper presented at a meeting of the Transmission and Distribution Committee, EEI, Swampscott, Mass., Oct. 12, 1948

THE practice of eliminating gaskets on underground submersible transformers and substituting welded, brazed, solder-sealed and pipe-threaded attachments was adopted by the Consolidated Edison Company of New York, Inc., in 1940. The program calls for the elimination by the manufacturer of as many gaskets as possible on new transformers and in the shop on transformers brought from the field for reconditioning. At the present time, new and reconditioned equipment issued for installation on the system is free of all gasketed attachments, with the exception of the ground-switch operating shaft which is sealed by means of a packing gland. It is expected that this packing will be eliminated in the near future.

It is the purpose of this paper to summarize pertinent information on the subject of gasket elimination, means of accomplishing it, and field experience.

Leaks in transformers are discovered during periodic inspections and tests. They represent a hazard from the time the leaks develop to the time they are discovered and corrected. Increasing the frequency of inspection does not remove the hazard, it merely reduces the duration of the hazard.

Leaks in submersible transformers cause loss of insulating fluid, drawing in water, breathing of air and consequent effect on oil dielectric strength, acidity and sludging. The repair of leaks in the field, especially when they require the removal of top covers on large transformers, is a difficult operation subject to the additional hazard resulting from traffic conditions, limited working space in the manhole and inclement weather. The conversion of the underground transformer into a hermetically sealed unit improves performance, eliminates to a large extent the sources of field maintenance, permits a reduction in the frequency of field inspection and test, and extends the life and quality of the insulating fluid.

Data are furnished in this paper concerning the frequency of leaks in transformers equipped with gaskets, and comparative performance of similar transformers where practically all the gaskets have been eliminated by welding of tank covers, handhole covers, elimination of gasketed primary and secondary glands, brazing of thermometer wells, elimination of gasketed oil level indicators and substitution of provisions for portable gages. Primary cable sheaths are now "wiped" to sleeves brazed or welded to the tank. Secondary solder-seal bushings are used in place of conventional gasketed bushings.

The replacement of gaskets by welding in the shop does not involve any increase in cost. Our investigation indicates that costs are about the same as replacing gaskets with similar gaskets.

Operating Experience—Gasketed Versus Welded Transformers

Table I gives detailed data on operating experience with gasketed-versus-welded transformers. Approximately 18 per cent of gasketed transformers develop the defects listed each year. The corresponding figure with welded equipment is down to approximately 1 per cent. The figures on gasketed transformers are based on a much greater number of units and on equipment which has been in service for a much greater period of time than in the case of sealed transformers. However, in the case of welded transformers, any defects in welding, brazing, wiping and solder sealing are likely to show up fairly soon after installation, and once corrected, should give trouble-free performance for a long period of time.

With the reduction in the number of leaks indicated above, the next major item in maintenance and replacement of field equipment is corrosion on transformer tanks and tubes. Table II illustrates the part which corrosion plays as the cause of replacement of transformers in the field. While it is not the purpose of this paper to go into detail on the subject of transformer corrosion, we wish to point out the importance of this item and emphasize to manufacturers and users the attention it deserves.

The type of steel used in the manufacture of tanks and tubes, the paint system, the details of construction of the bottom plates and supports which in some designs permit the accumulation

TABLE I

LEAKS FOUND DURING 1946 AND 1947 FIELD INSPECTIONS ON UNDERGROUND 13 AND 27 KV SUBMERSIBLE 500 KVA 3ϕ TRANSFORMERS

Type of Leak	1619 Transformers With Gaskets 5096 Inspections In Two Years	75 Transformers Shop Welded 405 Inspections In Two Years	193 Transformers Factory Welded* 1088 Inspections In Two Years
Top Cover Gasket	79	0	0
All Other Cover Gaskets	25	0	0
HV Chamber Cover and Plate Gasket	104	0	0
Sec. Chamber Cover and Plate Gasket	15	0	0
Oil Gauges, Thermal Indicators, Wells	44	1	0
Sampling Cocks, Drain Valves, Fittings	2	0	1
Tap Changer Packing Gland (Welds, Pipe Plug Threads)	2	0	1
Grd. Sw. (Including Interlock) Gland	93	0	0
HV and LV Bushing Gaskets	51	0	0
HV and LV Bushings (broken - defective)	31	0	0
HV and LV Glands	150	1	0
Low Dielectric - Main Tank	0	0	0
Low Dielectric - HV Chamber	0	0	0
Moisture - Main Tank	1	0	0
Moisture - HV Chamber	0	0	0
Welds	0	0	0
Total Leaks	597	2	2
Leaks per 1000 Transf. per Year	184.5	13.3	5.17
Leaks per 1000 Inspections per Year	119.4	2.45	0.92

* 188 of these are equipped with solder-seal bushings.

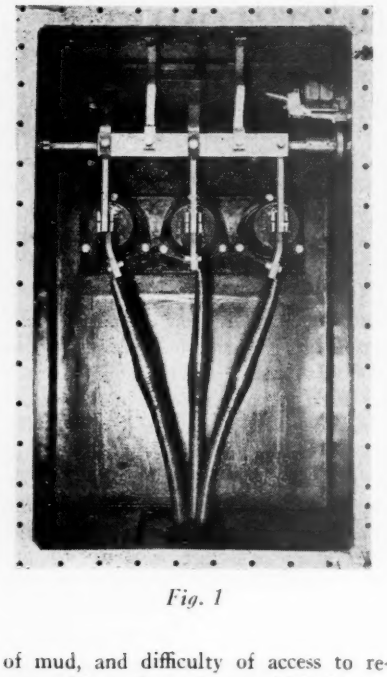


Fig. 1

Fig. 2

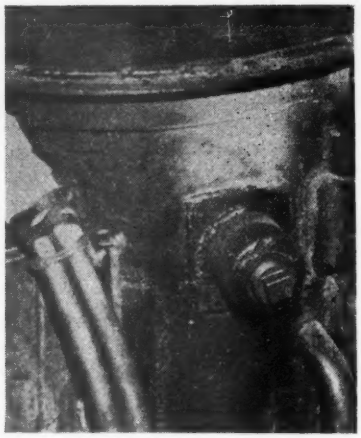


Fig. 3

Figs. 1, 2 & 3, at left and above, were taken after reconditioning. In Fig. 1, original bolted design gland plates of HV terminal chamber were burned out and new gland plate with single gland welded on. In Fig. 2, HV terminal chamber cover is welded; flush-type gage is eliminated and fluid level is determined with manometer through fitting. Handhole covers over openings for HV cable terminals and electrical interlock are welded. Fig. 3 shows welded cover with 2-in. pipe plug opening over tap changer operating head.

of mud, and difficulty of access to remove this mud, are items which deserve considerable attention. It has been found, for example, that transformer bottom plates which have been pressed to form a dished construction so as to establish a low point for the collection and drainage of water, are particularly subject to corrosion on the under side of the tank bottom plate at the areas where the metal has been stressed in order to form the dished portion. Supporting channels under the transformer tank should be parallel so that mud collected under the transformer can be washed away and thus reduce corrosion at this point.

Consideration must also be given to the increasing use of calcium chloride and salt in melting ice on city streets. This chemical finds its way into man-

(Continued on page 386)

TABLE II

REASONS FOR SHOP RECONDITIONING OF
3 PHASE 13 & 27 KV SUBMERSIBLE
TYPE TRANSFORMERS

The causes for removal from the system and reconditioning of these transformers are subdivided as follows -

	Rusted Tanks	Bushing Gaskets	Cover Gaskets	Rusted Tanks & Cover Gaskets	Cover & Bushing Gaskets	Rusted Tanks & Bushing Gaskets	Rusted Tanks Bushing & Cover Gaskets	Misc.	Total
27 KV Transformers									
%	22.7	11.8	35.6	11.8	7.2	5.4	3.8	1.7	100
13 KV Transformers									
%	2.2	1.3	67.7	21.5	1.8	-	1.4	4.1	100

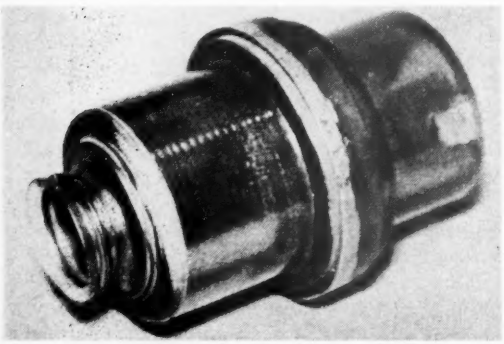


Fig. 4—Low Voltage Solder Seal Glass Bushing for 500-Kva Transformer. Metal Inserts Imbedded in Glass at End and Shoulder of Glass.

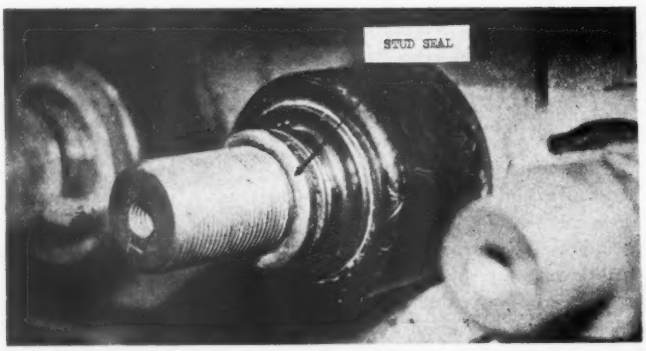


Fig. 5—Same Bushing as Fig. 4 Installed in Network Protector Mounting Throat on Submersible Transformer. Seal to Stud Exposed, but Tank Wall Seal Covered by Clamping Ring.

Information On Seven Major Prize Competitions

Awards for Individual and Company Achievement In 1948 Electrical Operations Are Described

INDIVIDUAL and company achievements in various phases of electric operations during 1948 will compete for prizes and nationwide recognition in seven major annual contests announced by the Edison Electric Institute. Entries will be judged early in 1949, and each award will be presented at either the 1949 annual convention or the annual sales conference.

The competition for one of the principal awards, the Charles A. Coffin Medal, is being conducted under a new procedure which was described in detail in last month's BULLETIN.

With the exception of the Coffin Award, administered by the Charles A. Coffin Award Committee, all Institute-sponsored prize contests are under the jurisdiction of the Prize Awards Committee, headed by H. M. Sawyer. Four of the contests stress commercial activities, while the Claude L. Matthews Valor Award is given in honor of acts of courage beyond the call of duty.

In the commercial competition, the Planned Lighting Awards are making their first appearance, having been made available by the Better Light-Better Sight Bureau and the Institute last May. The other awards attracting sales force attention are the George A. Hughes Awards, the Thomas W. Martin Award, and the Laura McCall Awards.

In addition to announcing the awards which it sponsors, the Institute has also made a practice of announcing at its annual conventions the Reddy Kilowatt Annual Report Award, presented to the electric company preparing the best annual report, although this contest is administered and sponsored by the Reddy Kilowatt Service.

Planned Lighting Awards

Prizes totaling $1,400 will be awarded in the Planned Lighting Contest, with first prizes of $200 being given in each of three fields—residential, commercial, and industrial. Second prize in each category is $100. In addition, an engraved bronze plaque and $500 in cash will be given to the company with the best program in all three markets combined. In the separate categories, certificates of merit will go to the companies, while the cash awards will be made to the individuals responsible for the specified field.

Objective of the Awards is "to give recognition to utility operating companies which are most effective in raising the standard of lighting in their communities. Equal emphasis will be given to educational programs on the relationship of light and sight for the public and allied electrical industries, and to sales promotional programs to sell Planned Lighting in the entire local market."

Programs sponsored during the 12-month period ending Feb. 28, 1949, will be considered. All entries must be postmarked or received at the EEI not later than midnight, April 15, 1949. All electric utility operating companies, whether or not members of the EEI, are eligible to enter the contest.

Separate entries must be made for each of the different types of market in the area served by the company. All homes —urban, suburban, and rural—will be included in the residential market, while the commercial market will consist of schools, offices, public buildings, stores and comparable trade establishments. The industrial market will include all local industries.

The Chairman of the Commercial Division General Committee, the EEI Commercial Director, and the Chairman of the Better Light-Better Sight Bureau will appoint the judges, and their selection of the winning entries will be based on consideration of two main factors—educational activities in the principles of Better Light-Better Sight, and sales promotion and selling of planned lighting installations.

Educational activities include education of company personnel, personnel in other branches of the electrical industry, and the education of all categories of consumer. Sales promotion includes consideration of company organization and methods, cooperative activities with local electrical industries and trades, consumer activity, and the over-all results obtained.

Suggested as possible aids in the preparation of entries are the EEI Planned Lighting Program Plan Books, released late in 1947. Elaborate entries are unnecessary. Simple reports and exhibits in evidence of accomplishments should be presented.

The Planned Lighting Awards will be made at the 1949 annual convention of the Institute.

George A. Hughes Awards

Carrying a total of $2,000 in cash prizes, the George A. Hughes Awards of trophies and plaques are offered through the EEI to the operating utility companies in the United States, and to individuals in those companies, for the most outstanding achievement in the promotion of electric cooking and water heating during 1948.

Prizes are given in each of four classes —electric kitchen promotion, domestic electric range promotion, electric water heater promotion, and commercial electric cooking promotion. The first place company in each class receives a trophy, while the company placing second in the class is awarded a plaque. In the electric kitchen category, the individual winner receives $500, while the second-place individual is awarded $300. Individual winners in the other three classes each receive $250, while second money is $150.

In making their decisions, the judges will consider advertising methods, sales training programs, activities with builders and architects to promote electric cooking and water heating in new homes, work with home economics teachers on the installation of similar equipment in classrooms, electric kitchen promotion, activities of utility home economists in promoting electric cooking, and other promotional activities.

Reports should be simple and straight statements of fact, including points and statistics needed by the judges in making the awards. Companies may enter any or all of the four classes, and may win prizes in more than one class.

All entries must be submitted to the Edison Electric Institute on or before Feb. 1, 1949. Awards will be made at

the 15th annual EEI sales conference in Chicago, April 5-7, 1949.

Thomas W. Martin Award

Consisting of a plaque presented to the winning company, the Thomas W. Martin Award is offered annually to the operating utility that makes the greatest contribution to the progress of farm electrification and to general agricultural development.

Consideration will be given by the judges to the factors of agricultural advancement within the company's territory due to use of electricity; development of farm load; cooperation with other agencies; organization and plans for conducting a rural development program designed to build a more prosperous agriculture; and extension of rural lines.

It is emphasized that the merit of the enterprise will be the prime factor in judging the contestants, not the method of presentation. Elaborate and costly exhibits are entirely unnecessary. Reports and exhibits for 1948 must be forwarded to the Secretary of the Institute by Feb. 1, 1949.

The winner will be announced and the prize awarded at the EEI sales conference in April, 1949.

Laura McCall Awards

Bronze plaques and cash awards totaling $1,000 are offered by *McCall's Magazine* through the EEI for ideas or achievements which represent advances in modern homemaking brought about by the use of electricity.

Achievements and ideas may include home call operation, kitchen planning, education of the homemaker in the use of electric appliances, home lighting activities, community or educational group activities, home service calls and other helps on equipment sold by dealers, employee education programs and cooperation with other departments within the company, or any other outstanding home service activity.

Three divisions are open to contestants from any electric company in the nation. Division A includes companies in which the entire home service personnel totals more than three individuals. Division B is limited to companies having not more than three home service representatives. The winning home service director in each of these divisions will receive $200 and an engraved bronze plaque for making the greatest contribution in any one or more of the fields of activity listed above.

Division C awards will be made to three individual members of home service departments "whose ideas, in the opinion of the Jury of Awards, make in the most practical and original manner, the greatest contribution to the advancement of modern homemaking through the use of modern electrical household equipment." Each of the three individual winners in this division will receive $200 and a plaque.

Although individuals and companies may compete in more than one division, only one award will be made to any individual or company. The contest covers the year ending Feb. 1, 1949, and entries must be postmarked or received at the Institute before midnight on that date. Awards will be made at the 1949 EEI sales conference.

Claude L. Matthews Valor Award

The Claude L. Matthews Valor Award was established "to honor acts of devotion to duty wherein extraordinary courage has been exercised in efforts to maintain important electric service or to restore service in the shortest possible time."

Each year three cash awards of $150 each are made available to the electric utility employee or employees qualifying as most entitled to the Award. In addition, a citation and a handsome 2½-inch bronze medal will be given to each employee cited for the Award. Employees of any electric company, publicly or privately owned, are eligible.

In making their decision, the judges will take into account the importance of the service affected, the courage, good judgment, quick action, and devotion to duty displayed by the employee.

The chief executive of the utility must submit the recommendation for the Award, including a citation of the act of devotion to duty, the duty or duties with which the recommended person was charged, a brief description of the events, a statement of the deed upon which the claim for the Award is based, and a brief history of the employee's service.

Recommendations for 1948 must be forwarded to the Secretary of the Institute not later than March 1, 1949.

Reddy Kilowatt Annual Report Award

Established in 1939, the Reddy Kilowatt Award of a bronze plaque is made annually to the electric light and power company that "best illustrates, humanizes and simplifies to stockholders the company's operations during the preceding year."

All electric companies are eligible to enter the contest. Five copies of the 1948 annual report of each company competing must be received by the Reddy Kilowatt Service, 50 Church Street, New York 7, New York, on or before May 15, 1949.

In addition to selecting the winner, the judges will single out companies to which honorable mention certificates will be awarded. Presentation of the awards will be made at the EEI's annual convention in June, 1949.

Elimination of Gaskets on Underground Submersible Transformers

(*Continued from page 384*)

holes and sidewalk vaults and contributes to the corrosion of tanks. In a recent issue of a New York City newspaper, it was stated that the City of New York has 12,000 tons of rock salt on hand and 20,000 tons on order for use on city streets this winter.

Figs. 4 & 5 show a solder-seal bushing utilizing the principle of embedding metal details in cast glass housings. This particular design has been proved to be more satisfactory than the type which consists of a porcelain bushing to which the metal details are soldered.

Summary

1. The elimination of gaskets on submersible transformers results in a major reduction in the number of leaks, and consequently improved performance.
2. The cost of replacing gasketed covers, etc., in the shop with welded attachments is about the same as replacing the defective gasket with a new gasket.
3. Methods are available as illustrated in this paper for the elimination of the various gaskets and gasketed fittings, except the ground switch packing gland.
4. The importance of concentrating on improvements which will eliminate or reduce tank corrosion is emphasized. With the elimination of gasket leaks, corrosion will become the main source of operating difficulties requiring the replacement of the transformer.

Report of the Meeting of

ACRMA-EEI-NEMA-REMA Joint Committee on Air Conditioning and Refrigerating Equipment

Cleveland, Ohio, September 21, 1948

By J. W. Anderson

Philadelphia Electric Company

A paper presented at a meeting of the Transmission and Distribution Committee, EEI, Swampscott, Mass., October 11, 1948

IT has been a matter of considerable regret that several large manufacturers of room air conditioners continued in 1948 to market a considerable volume of nominally ¾-hp units with 115-volt motors having locked rotor currents of 50 amperes or more, with no provision for their operation at 230 volts. It was hoped that in 1948—two and one-half years after the joint ACRMA-EEI agreement on this subject—considerably more progress would have been made.

Motor Starting Current Rules

Some confusion has arisen regarding the relationship of the agreement referred to above and the report of the Joint AEIC-EEI-NEMA Committee on Single Phase Motor Starting Currents. This ACRMA-EEI agreement referred to room air conditioners for residential applications, i. e., light load density areas, whereas the report of the Joint Committee refers to all motor driven appliances in general. Now that this report* has been printed and distributed to EEI member companies, it should be considered as replacing the corresponding rules in the earlier ACRMA-EEI agreement. Observance of the recommendations of this report both by utility companies and the air conditioning industry should eliminate the confusion that has arisen and simplify the problems of both groups to their mutual advantage.

These and related matters were discussed at a meeting of the ACRMA-EEI-NEMA-REMA Joint Committee on Air Conditioning and Refrigerating Equipment in Cleveland on September 21, 1948. The discussion developed several points which will be of interest to the membership of the Transmission and Distribution Committee.

Air conditioning industry representatives raised questions as to the interpretation of the recommendations of the report on Single-Phase Motor Starting Currents with respect to current reducing motor starters and with respect to multi-motored appliances, having in mind the fan motors which are an integral part of a room air conditioner as well as the possibility of a room cooler having two small compressor motors rather than one large one. Since several persons present were among those who drafted the proposed motor starting current rules, it was possible to give the following as to the intent of the report in question:

1. When a current reducing starter is used, the locked-rotor current to be considered is the current taken from the line with the rotor locked, with the starting device in the starting position, and with rated voltage and frequency applied.
2. In the case of a multi-motored device arranged for sequential starting of the motors, the suggested rules are considered to apply to the locked-rotor currents of the individual motors—if arranged for simultaneous starting of the motors the rules apply to the sum of the locked-rotor currents of all motors so started.

The administration of the proposed motor starting current rules in accordance with the above statement is strongly urged by EEI representatives on the Joint Air Conditioning Committee.

Air conditioning industry representatives also stated that one of the major considerations hampering more rapid progress toward the general use of 230-volt motors was the lack of existing 3-wire secondary services in light load density areas throughout the country and the reluctance, on account of cost, of utility companies to add the third wire to existing 2-wire services except at customer expense considered unreasonably high. They emphasized the need for power companies to make 3-wire service generally available with as little difficulty to the customer as possible and to advise local air conditioning selling agencies as to the conditions under which the third wire would be added. EEI representatives agreed that this is an important point and believe that the benefits to be derived from general use of 230-volt motors warrant further careful study and review of the possibilities from an economic standpoint of making 3-wire service more generally available.

Tolerances Discussed

Considerable discussion also took place concerning the plus 15 per cent tolerance in locked-rotor currents proposed in the motor starting current report as a tolerance for testing individual motors. Air conditioning industry representatives stressed the high starting torque requirements of compressor applications and their need for the maximum possible permissible locked-rotor current to meet this condition, particularly under the kw voltage conditions they now encounter in local areas throughout the country. It was their feeling that utility companies should permit the maximum use of this tolerance in applying the proposed motor starting current rules to air conditioning equipment, i. e., a locked-rotor current of 40 amperes plus 15 per cent or 46 amperes should be accepted for 115-volt motors. EEI representatives are in accord with this point of view and, bearing in mind that many motor driven appliances have inherently low starting torque requirements and consequently less than maximum permissible locked-rotor currents, recommend that the proposed motor starting current rules be administered on this basis.

Stressing the time required for their industry to change their designs to provide for general use of 230-volt motors on the larger room air conditioners, the

(*Continued on page 392*)

* Single-Phase Motor Starting Current Rules, EEI Pub. No. Q-8; NEMA Pub. No. 116.

Transmission and Distribution Committee Meeting

T. J. Brosnan, *Chairman*

THE fall meeting of the Transmission and Distribution Committee was held on Oct. 11 and 12 at the New Ocean House, Swampscott, Massachusetts, with 150 members and guests in attendance.

Standards and Specifications

Subcommittee activities of the Standards and Specifications Group, sponsored by W. E. Losie, were summarized.

F. A. Ashbaugh announced that the Timber Products Subcommittee has completed the proposed revision of specifications for Douglas Fir crossarms which now will be submitted to members for ballot. Progress is being made on a similar new specification for Southern Pine crossarms.

R. M. Havourd reported that the draft of proposed EEI-NEMA specifications for suspension insulators is nearing completion. The Connector and Splice Subcommittee contemplates early completion of a guide for the selection and installation of connectors and splices for particular applications. It is anticipated that trial use of this guide will provide a basis for future preparation of formal specifications for these items.

Further progress in the preparation of EEI-NEMA joint standards for distribution fuses was outlined by W. L. Vest, Jr. Tentative time-current curves for a standard series of slow fuses have been completed and curves for a series of fast fuses are under preparation.

E. K. Karcher reported that TD-7 "Specifications for Spool Type Secondary Racks" now is ready for publication. TD-17 "Specifications for Bolt Type Steel Insulator Pins with 1-in. Diameter Lead Threads" has been published and the Line Hardware Subcommittee now is preparing a companion specification for ⅜-in. pins as well as other specifications for guy thimbles, expansion anchors and steel clevises.

Continued progress in the preparation of EEI-NEMA standards for street lighting equipment was outlined by R. J. Palmer.

M. L. Hurni of the General Electric Company gave a detailed explanation of the use of standard symbols for representing transformer voltages and made a plea for proper and consistent use of these symbols.

Statistical methods applied to sampling were described by J. J. Taylor of the Ohio Brass Company. Evidence obtained from sampling is proportional to the number of samples tested and is almost independent of the size of the lot. Thus, percentage sampling is an illogical basis for testing.

Plans for regularly scheduled discussions of specific phases of safe design and operation were described by C. E. Bathe, sponsor for this new activity.

General Engineering

The General Engineering Group, sponsored by L. G. Smith, featured a discussion of the interrelation of substation regulation and distribution system design.

L. M. Olmsted presented an analysis of the use of various regulating schemes on a typical 4160-v No. 4/0 feeder indicating that the most effective control is provided by single-phase regulators with a neutral compensator. Omission of the neutral compensator is more than offset by added line cost for feeder lengths over 1000 ft. Substituting a three-phase regulator provides savings for feeders up to 2500 ft in length but places a premium on phase balance. Combining two feeders on one three-phase regulator or combining regulating equipment with substation transformers provides further savings but adds a premium on balance between feeders.

The Chairman described a uniform procedure developed by his company to calculate feeder regulation and outline a routine for improving substandard voltage conditions. Both feeder and bus regulation are employed at substations as applicable. Corrective measures for individual feeders are capacitors, supplementary feeder regulators and increased wire size applied in that order.

M. S. Oldacre outlined the need for restudy of the flicker problem taking into account the effect of new types of equipment that create cyclic variations, the newer type lamps and the combination of different types of flicker producing devices on the same service.

J. W. Anderson reported that the AEIC - EEI - NEMA Joint Report on Single-Phase Motor Starting Currents has been published. He also gave a report on activities of the ACRMA - EEI - NEMA - REMA Joint Committee on Air Conditioning and Refrigerating Equipment. A separate article on this subject is included elsewhere in this issue of the BULLETIN.

R. E. Morse presented a report by H. A. Enos outlining plans for research on load characteristics that influence distribution system design and operation.

Progress of the AEIC-EEI Committee on Branch Circuit Protection was described by E. V. Sayles. A laboratory study being carried on for the Joint Committee by Underwriters Laboratories is approaching completion. Most of the other aspects of the work are well in hand, and the Joint Committee's report is now in course of preparation.

P. F. O'Neill presented the results of an investigation of the effect of voltage level on the input characteristics of certain types of motor-driven utilization equipment. Three-hp induction motors tested showed no significant change in kw demand over a wide range of voltage while certain small motor-driven devices such as office fans and washers showed wide variations.

Underground Group

The Underground Group, sponsored by J. A. Pulsford covered a variety of subjects.

Final details of 1946 cable operations were reported by E. F. Nuezel. The cable trouble rate of 7.3 per 100 cable miles in 1946 represents an increase over recent years. This rise was due to an increase in non-inherent types of failure. The failure rate for oil-filled cable was 2.8 compared with 0.8 in 1945 but there were no failures due to inherent causes. The joint trouble rate of 1.1 per 1000 joints in 1946 equalled the lowest rate on record. The termination trouble rate was 0.7 per 1000 terminations. Although 54 per cent of the terminations are integral with apparatus none of these failed in 1946. Preliminary data for 1947 indicates a further increase in the trouble rate for cable to 7.6 per 100 cable miles and an increase in the trouble rate for joints to 1.4 per 1000 joints.

Experience with the use of non-leaded underground cable was reviewed by R. E. Morse, G. S. Van Antwerp, J. E. McCormack, M. W. Ghen and the Chairman. The relatively short life experienced with earlier types of rubber and braid cable for use at secondary volt-

ages has been greatly improved with the introduction of neoprene jackets. However, there is still a divergence of opinion regarding the use of non-leaded cable at primary voltages.

M. W. Ghen described progress in the development of EEI-NEMA standards for underground transformers. A draft of standards for conventional submersible type transformers 167 kva and smaller single-phase, 150 kva and smaller three-phase; high voltage 2400-15,000 v, low voltage, 600 v and below is nearing completion and soon will be sent to users of this type equipment for comment. This draft attempts to recognize recent advances in design and specifies an all-welded construction.

C. P. Xenis described the practices of his company in eliminating gaskets on submersible transformers. Methods are available for eliminating all the various gaskets and gasketed fittings with the exception of the ground switch packing gland. Elimination of these gaskets has resulted in a major reduction in the number of leaks and consequently in improved performance. The cost of replacing gasketed covers with welded covers was described as comparable with that of replacing a defective gasket. A movie showing the technique employed in welding covers and attachments also was shown.

Overhead Group

Aerial cable was a featured subject of the Overhead Group.

R. C. Waldron of the Okonite Company described a pre-assembled, self-supporting aerial cable consisting of individually insulated, non-shielded, neoprene jacketed conductors cabled together with the direction of twist reversed at 5-ft intervals and bound to a Copperweld messenger with a flat copper tape. The reversal of twist permits the conductors to be separated for making hot taps without cutting the conductors. A model demonstration of separating the cable for a tap was followed by a movie showing the complete splicing and tapping operation on an actual installation.

W. R. Bullard showed a movie of the installation of field assembled aerial cable by the Florida Power and Light Company. The messenger is first installed and prestressed. The desired number of conductors then are pulled in and lashed to the messenger with a specially designed travelling spinner which rides the messenger behind a stringing trolley which straightens and forms the conductors into a uniform triangular configuration.

C. J. Beller described progress of the proposed AIEE-EEI study to determine preferred types of distribution design and protection from the standpoint of service reliability and overall economy. It is planned to ask each company represented on the T & D Committee to report on two representative urban, suburban and rural circuits. Sample forms for reporting the desired data have been completed.

Preliminary results of AIEE-EEI survey of shunt capacitor performance were reported by H. E. Stites. On a combined system of 10,145,000 kw, 911,000 kvar of capacitors have been reported to date. The number of failures is about 1 per cent of the total installation. Protection schemes vary with 83 per cent using lightning arresters. Inspection practices vary widely.

Further progress in the proposed AIEE-EEI survey of outages on transmission lines above 100 kv was reported by M. H. Pratt.

W. M. Penney called attention to the problem of obtaining required ground clearance for service drop attachments to the increasing number of ranch style houses with eaves only about 8 ft above the ground all around the house.

L. F. Hickernell presented data concerning the annealing characteristics of copper wire and described a new brand of copper having increased resistance to annealing which permits higher current carrying capacity.

Electrical Equipment Committee Meeting

B. Van Ness, Jr., *Chairman*

THE 46th meeting of the Electrical Equipment Committee, held at the Wm. Penn Hotel, Pittsburgh, Pa., on Oct. 14 and 15, was attended by a record number of 85 members and guests.

On Oct. 13 the Committee, along with the EEI Prime Movers and the AEIC Switching and Switchgear Committees were guests of the Westinghouse Electric Corporation at a Power Engineering Conference. An interesting program was provided consisting of talks concerning developments since the similar meeting held in 1944 in generators, turbines, transformers, bushings and switchgear. In the afternoon, a tour of the Westinghouse East Pittsburgh Works was made. Rotating machinery, bushings and switchgear in various stages of manufacture were observed. The Westinghouse Electric Analog Computer Board was demonstrated. This device solves complicated electrical and mechanical problems in a fraction of the time required by conventional methods.

Apparatus Troubles

Because of the interest shown by the members in the discussions of items included in the closed sessions, attendance at which is limited to members and invited guests of the Committee, the full day of Oct. 15 was devoted to this type of session. Informal reports on apparatus troubles and new equipment purchases were presented followed by prepared and general discussion.

F. S. Brown, Sponsor for Oil Fires and Apparatus Troubles, gave a summary of cases reported to him since the last meeting. The report on Apparatus Troubles indicated that the average number of failures during the period was 26 per month compared to the 10-year average of 22 per month. Major troubles were reported in 36 cases with transformers of over 500 kva capacity accounting for 11, and oil circuit breakers accounting for 8. Minor troubles, of which there were 117, were largely attributed to transformers, all types, (24), induction regulators (16), lightning arresters (13), and motors (10). A total of 17 oil fires were reported, of which transformers accounted for 8, oil circuit breakers 6, and induction regulators 3.

Power Circuit Breakers and Switchgear

Activities of the Joint AEIC-EEI-NEMA Committee on Power Circuit Breakers and the AEIC Committee on Switching and Switchgear were reported by R. W. Wilbraham. The proposed new power circuit breaker rating tables prepared by the Joint Committee have been approved by the ASA Committee and will be published as a supplemental revision of ASA Standard C37.6 soon. Mr. Wilbraham indicated that double range of closing voltage for solenoid-operated mechanisms will be provided in the future either by the use of tapped coils or some equivalent method. The report on Uniform Requirements for Metalclad Switchgear has been printed as a Joint AEIC-EEI-NEMA publica-

tion. Copies are available as EEI Publication No. Q4. Regarding spare parts for old power circuit breakers, the manufacturers have agreed to issue annually a list of items available. One year's advance notice will be given in the future before an item is dropped from the list.

A round table discussion of excitation and voltage regulation was held under the sponsorship of L. Birckhead. Geared versus direct-connected versus motor-driven exciters; rheostatic versus rototrol and amplidyne regulators were discussed. It was indicated that each of the various types had advantages and disadvantages and the choice seemed to be based on past experience and special considerations that may be required for individual systems.

Electrical Testing of New Station

The discussion resulting from H. E. Deardorff's presentation of the Electrical Testing Features involved in starting the O. H. Hutchings Station, which is reprinted in this issue of the BULLETIN, indicated that this subject was of keen interest to the members at this time. It was generally agreed that, in spite of pressure to get units in operation in the shortest possible time, the testing and overall checking should be thorough even though it means a delay in starting the unit. It was pointed out that a relatively short time spent in testing may prevent shutdowns of relatively long duration.

In describing the plans for expansion of the Detroit Edison Bulk Power System to match a 30 per cent expansion of generating capacity within the next few years, A. P. Fugill indicated that interruption duty of circuit breakers was an important consideration. Fault limiting reactors were utilized sparingly and primarily to limit fault duties to that for which breakers are readily available. They did not attempt to keep the maximum fault duties on the system within the ratings of breakers presently installed. Instead, breakers with increased ratings will be procured and some present breakers will be modernized. The higher capacity breakers then will be installed on portions of the system requiring high fault duty. A large percentage of the present breakers will be relocated so that practically all of them can be utilized without exceeding their ratings.

Voltage conditions will be maintained primarily by generator voltage regulation with sufficient impedance separating the different network areas to provide voltage independence. The reactive requirements of the system will be provided to a large extent by the generators but some synchronous condensers and static capacitors are to be used.

Interesting data concerning engineering and economic consideration in the use of aluminum for bus structures, cable and conduit wiring were provided by L. T. Guess of the Aluminum Company of America. Relative weight, conductivity and costs of aluminum compared to other types of conducting material were discussed and methods of making comparison studies outlined. Research and tests leading to the development and improvement of fittings and hardware for insulated aluminum cables have been instituted by his company.

D. M. Quick described the welded aluminum buses used at the Sewaren Generating Station. Mr. Quick's paper will be reprinted in the next issue of the BULLETIN. In the discussion that followed, it was brought out that welded aluminum buses for this installation represented a saving over bolted copper buses. No data were available to indicate whether or not there was a saving over bolted aluminum buses.

The largest installation of series capacitors (10,000 kva), in the world was described by J. M. Arthur. The use of series capacitors was found in this installation to be the most economical solution to voltage fluctuation problems created by electric arc furnaces. Calculations indicated that self-excitation of large induction motors would exist with the capacitors installed unless a damping resistor was utilized. Tests indicated that a 400-ohm resistor in parallel with the capacitors in each phase provided satisfactory damping. The voltage fluctuations were reduced from a range of approximately 98-121 volts to a range of 110-121 volts with the capacitors in service.

A. V. DeBeech reporting on activities of the Foreign Practices Division indicated that means of reducing peak load demands during the winter months are being given considerable attention in Great Britain and Canada at this time. In regard to the plans for changeover from 25 to 60 cycles in Southern Ontario, Canada, Mr. DeBeech reported that a manufacturer recently announced a line of induction motors up to 200-hp internally re-connectable from 25 to 60 cycles. The motor speeds are 1500 rpm for 25 cycles and 1800 rpm for 60 cycles.

Electric Power Supply and Load in the U. S.

(*Continued from page 362*)

and up to the beginning of World War II.

2. "Power was never too little or too late" during World War II and if there is no unwarranted interference with the present program, the same should be true in case of another major war.
3. There is no indication that the power program would in any way retard the war effort in case of another world war.
4. The power industry is scheduling, and the manufacturers are producing all of the electric power capacity that the availability of steel and other materials will permit.
5. The present program calls for an increase in capacity of over 50 per cent or between 26,000,000 and 29,000,000 kw from 1947 to 1952 inclusive.
6. This program indicates that by 1951, we will be having a very satisfactory margin of capacity over peaks.
7. In 1947, hydro capacity was 26 per cent of the total. Of the new capacity on order, 18 per cent is hydro. This tendency of greater dependence on fuel generation will continue.
8. During this year and into next, we will have areas where there will be some load adjustment during periods of dark weather, low river flow, and equipment outages.
9. Such load adjustments as are necessary will probably be over the heavy peak periods affecting a very minor part of the area load and will have an infinitesimal effect on the vast majority of electrical users.
10. The prosecution of another major war would have to be based on the knowledge that our supplies of basic materials are not limitless and causes other than electric power would probably be our limiting factors.

PERSONALS

L. C. McCLURKIN, formerly president and general manager of the Upper Peninsula Power Company, Houghton, Mich., has been elected president of the Savannah (Ga.) Electric & Power Company, to succeed CLAUDE C. CURTIS, who has resigned on reaching retirement age.

Mr. McClurkin has been associated with the utility industry for 28 years, joining the Eastern Texas Electric Company, Beaumont, in 1920. In 1934 he became identified with the Texas-New Mexico Utilities Company as sales manager and later served as division manager at Plainview. Five years later he became general manager of the Arkansas Utilities Company with headquarters in Helena. Subsequently he was made president and general manager of the company, and later of the West Coast Power Company and the California Public Service Company. He then joined the Houghton County Electric Light Company, serving as its president and general manager, holding the same position with its successor, the Upper Peninsula Power Company.

Mr. Curtis retired as president of the Savannah utility after completing 10 years of service in that office. He joined Stone and Webster shortly after graduation from the University of Michigan in 1907. From 1907 to 1912, he was superintendent and later manager, of the street railway, light and power company in Puerto Rico. He returned to New England with Stone and Webster and held executive positions in Texas, Nova Scotia, State of Washington and finally in New York. He then went to Savannah Electric and Power Company, where he succeeded Howard C. Foss.

EDWARD W. DILLARD has been appointed chief engineer of the New England Power Service Company, Boston, and HERBERT R. STEWART, since 1934 protection engineer of the company, has been appointed electrical engineer. HARRIS BARBER, since 1934 electrical design engineer (generating and substations), has been made assistant electrical engineer.

After spending a year with the General Electric Company, Mr. Dillard joined the Alabama Power System, becoming a relay specialist at Birmingham in 1914. In 1916 he became chief of tests on meters, relays, oil circuit breakers, and lightning arresters for the New England Power system. In 1919 he was named assistant electrical engineer. Since 1927 he has been electrical engineer of the now New England Power Service Company. He has been a director of the Service company since 1943. Mr. Dillard is a fellow of the AIEE, member of its transmission and distribution committee, and chairman of the Engineering Division General Committee, Edison Electric Institute.

Mr. Stewart was identified with the Westinghouse Electric Corp. from 1925 to 1934, in central station engineering at Pittsburgh and Boston. He was a research associate at MIT for a half year. Mr. Stewart is active in electrical committee work in the EEI and AIEE and is a fellow of the latter. In the recent war, he was loaned on part time to the Harvard Underwater Sound Laboratory.

Mr. Barber had spent four years with General Electric before joining the engineering staff of the New England Power group in 1928.

WILLIAM WEBSTER, executive vice-president, New England Electric System, Boston, has been appointed deputy secretary of defense for atomic energy, Washington, D. C. He has been granted a six months' leave of absence from his regular duties. In the interim CHANDLER W. JONES, assistant vice-president of the System, will carry on Mr. Webster's work at the utility headquarters. Mr. Webster will be aide to Secretary of Defense James V. Forrestal and will be chairman of the military liaison committee of the Atomic Energy Commission. Mr. Webster is a graduate of the U. S. Naval Academy and of Massachusetts Institute of Technology. He has been active in the work of the National Defense Research Committee and in the recent war was with the OSRD at Washington. Lately he has been a consultant of the AEC.

FREDERICK L. WITSELL, director of employee-customer relations department, Public Service Co. of Colorado, Denver, has been elected a vice president of that utility.

Mr. Witsell formerly was vice president and general manager of the Pueblo Gas and Fuel Company, a Public Service subsidiary, with which he became identified in 1940. Previously he had been connected with the Toledo Edison Company, and at the time he left to go to Denver he was occupying the position of superintendent of the district heating department.

JUDGE FREDERICK J. DUNN has retired as general counsel for the New England Electric System, Boston. He joined the then Connecticut River Transmission Company, Worcester, Mass., in 1914 as property attorney. The legal aspects of the System's development have been his chief responsibility for many years. He has also been president of the Gardner Electric Light Company, Northern Berkshire Gas Company, vice president of the New England Power Company and Green Mountain Power Corp.

GORDON W. EVANS, assistant to the president of the Kansas Gas and Electric Company, Wichita, for the past year, has been elected vice president of the company.

Mr. Evans has been connected with the utility field for almost 25 years. Before going to Wichita last year he was president of the Missouri Edison Company and the East Missouri Power Company, with headquarters in Louisiana, Missouri.

His early experience was obtained in Oklahoma with the Public Service Company of Oklahoma at Tulsa and with the Oklahoma Power and Water Company at Sand Springs.

D. F. McCURRACH, assistant general manager of the Pacific Power and Light Company, Portland, since 1942, has been appointed to a new position as assistant vice president in the rate and research department.

Announcement has been made of the appointment of WILLIAM E. MITCHELL, formerly president of the Georgia Power Company, as chief of the industrial division of the ECA mission to France. As director of the industrial division, Mr. Mitchell will screen French requests for industrial equipment, making recommendations for the allocation of American aid from the ECA program.

For many years a prominent figure in the electrical industry in the Southeast, Mr. Mitchell became identified with the Georgia Power Company in 1927 as

vice-president and general manager, having previously served with the Alabama Power Company for 15 years in several executive positions. He was elected president of the Georgia Power Company in 1945 and two years later retired. Mr. Mitchell has taken a leading part in the civic and public welfare activities of Atlanta.

EDWARD L. KELLER has been appointed superintendent of the meter division, substation and shops department, Duquesne Light Company, Pittsburgh, to succeed E. A. MURRAY, retired. Mr. Keller has been identified with the company since 1917.

ALFRED MAY, commercial manager of the San Diego Gas and Electric Company, San Diego, Calif., has retired after 37 years with the company. He was appointed to his present position in 1932.

RALPH R. EASTER has been appointed assistant to the Chairman of the Board of the Portland General Electric Company with headquarters at Portland, Ore. For 23 years he has been manager of the company's Tualatin Valley division. JOHN ENSCHEDE, assistant manager of the Tualatin Valley division, has been advanced to manager, succeeding Mr. Easter.

ACRMA-EEI-NEMA-REMA Joint Committee on Air Conditioning and Refrigerating Equipment

(*Continued from page 387*)

air conditioning representatives proposed a two-year moratorium on the enforcement of the 46-ampere locked-rotor limit for 115-volt motors. EEI representatives pointed out that they were not empowered to agree to such a proposal but felt that the two and one-half years elapsed since the ACRMA-EEI agreement had been approved by both industry associations, had offered sufficient time for the air conditioning industry to make a substantial start toward the objectives of that agreement. EEI representatives did agree, however, to call attention to the need for recognition of this interim situation in administering the proposed rules, with the understanding that ACRMA members would proceed as rapidly as possible toward 230-volt motors and/or the 46-ampere limit for 115-volt motors.

CONVENTIONS AND MEETINGS

1948

NOVEMBER

1-3 Wisconsin Utilities Association, Commercial and Technical Divisions, Pfister Hotel, Milwaukee, Wis.
4-5 Pennsylvania Electric Association, Systems Operation Committee, Benjamin Franklin Hotel, Philadelphia, Pa.
4-5 Pennsylvania Electric Association, Communications Committee, Hotel Schenley, Pittsburgh, Pa.
5-6 Public Utilities Association of the Virginias, Greenbrier Hotel, White Sulphur Springs, W. Va.
8-13 National Electrical Manufacturers Association, Hotel Traymore, Atlantic City, N. J.
10-12 Southeastern Exchange, General Sales Conference, Atlanta, Ga.
15-18 National Association of Railroad and Utilities Commissioners, Savannah, Ga.
17-19 National Farm Electrification Conference, Congress Hotel, Chicago, Ill.
18-20 New Jersey Utilities Association, Sea View Country Club, Absecon, N. J.
28-Dec. 3 American Society of Mechanical Engineers, Hotels Pennsylvania and New Yorker, New York, N. Y.
29-30 Prime Movers Committee, EEI, New York, N. Y.
30-Dec. 3 National Electrical Contractors Association, Roney Plaza, Miami Beach, Fla.

DECEMBER

5-8 The American Society of Refrigerating Engineers, Washington, D. C.

JANUARY—1949

19-21 American Society of Civil Engineers, Annual Meeting, New York, N. Y.
20 Industrial Relations Committee, EEI, New York, N. Y.
24-25 Accident Prevention Committee, EEI, Book-Cadillac Hotel, Detroit, Mich.
Jan. 31-Feb. 4 American Institute of Electrical Engineers, Hotel Pennsylvania, New York, N. Y.

FEBRUARY

10-11 Transmission and Distribution Committee, EEI, Netherland Plaza Hotel, Cincinnati, Ohio
13-15 Industrial Relations Committee, EEI, Chicago, Ill.
14-15 Electrical Equipment Committee, EEI, New Jefferson Hotel, St. Louis, Mo.

MARCH

13-18 National Electrical Manufacturers Association, Winter Convention, Edgewater Beach Hotel, Chicago, Ill.
17-18 Industrial Relations Committee, EEI, Baltimore, Md.
24-25 Southeastern Electric Exchange, Engineering and Operation Section, General Ogelthorpe Hotel, Savannah, Ga.
29-Apr. 1 Third International Lighting Exposition and Conference, Stevens Hotel, Chicago, Ill.

APRIL

5-7 Fifteenth Annual Sales Conference, EEI, Edgewater Beach Hotel, Chicago, Ill.
11-13 National Conference of Electric and Gas Utility Accountants, Book-Cadillac Hotel, Detroit, Mich.
13-15 Southeastern Exchange, Annual Convention, Boca Raton Hotel, Boca Raton, Fla.
20-23 American Society of Civil Engineers, Oklahoma City, Okla.

MAY

1-6 National Electrical Wholesalers Association, Netherland Plaza Hotel, Cincinnati, Ohio.
2-4 Engineering Committees, EEI, Edgewater Beach Hotel, Chicago, Ill.
2-5 Chamber of Commerce of the U. S. A., Washington, D.C.
16-19 National Fire Protection Association, Fairmont Hotel, San Francisco, Calif.

JUNE

1-3 ANNUAL MEETING, EDISON ELECTRIC INSTITUTE, Atlantic City, N. J.
20-21 Public Utilities Advertising Association, Netherland Plaza Hotel, Cincinnati, Ohio
28-30 Canadian Electrical Association, Banff Springs Hotel, Banff, Canada

EDISON ELECTRIC INSTITUTE OFFICERS AND COMMITTEES

OFFICERS

E. R. ACKER, *President*.....Central Hudson Gas & Electric Corp., Poughkeepsie, N. Y.
ELMER L. LINDSETH, *Vice-President*...The Cleveland Electric Illuminating Co., Cleveland, Ohio
H. S. BENNION, *Vice-President and Managing Director*. . .420 Lexington Ave., New York, N. Y.
K. B. CRUMB, *Treasurer*.....American Gas & Electric Service Corp., New York, N. Y.
MAE B. WOODS, *Secretary*.....420 Lexington Avenue, New York, N. Y.

BOARD OF DIRECTORS

(Terms Expiring 1949)

W. C. BECKJORD.....The Cincinnati Gas & Electric Co., Cincinnati, Ohio
W. H. BURKE.....Ebasco Services Inc., New York, N. Y.
W. G. B. EULER.....Pacific Gas and Electric Co., San Francisco, Cal.
A. H. KEHOE.....Consolidated Edison Company of New York, Inc., New York, N. Y.
FRANK KRUESI.....Central & South West Utilities Co., Wilmington, Del.
ELMER L. LINDSETH.....The Cleveland Electric Illuminating Co., Cleveland, Ohio
P. H. MCCANCE.....Duquesne Light Co., Pittsburgh, Pa.
C. E. MICHEL.....Union Electric Company of Missouri, St. Louis, Mo.
ALBERT T. O'NEILL.....Buffalo Niagara Electric Corp., Buffalo, N. Y.
J. W. PARKER.....The Detroit Edison Co., Detroit, Mich.
H. T. PRITCHARD.....Indianapolis Power & Light Co., Indianapolis, Ind.
K. M. ROBINSON.....The Washington Water Power Co., Spokane, Wash.
R. L. THOMAS.....Consolidated Gas Electric Light & Power Co., Baltimore, Md.
WILLIAM WEBSTER.....New England Electric System, Boston, Mass.

(Terms Expiring 1950)

E. R. ACKER.....Central Hudson Gas & Electric Corp., Poughkeepsie, N. Y.
AUSTIN D. BARNEY.....The Hartford Electric Light Co., Hartford, Conn.
REX I. BROWN.....Mississippi Power & Light Co., Jackson, Miss.
HANCE H. CLELAND.....San Diego Gas & Electric Co., San Diego, Calif.
E. W. DOEBLER.....Long Island Lighting Co., Mineola, N. Y.
J. A. LONGLEY.....Central Illinois Light Co., Peoria, Ill.
L. A. MAGRAW.....Central Illinois Public Service Co., Springfield, Ill.
H. B. MUNSELL.....Kansas City Power & Light Co., Kansas City, Mo.
R. S. NELSON.....Gulf States Utilities Co., Beaumont, Texas
C. E. OAKES.....Pennsylvania Power & Light Co., Allentown, Pa.
B. F. PICKARD.....Interstate Power Co., Dubuque, Iowa
MCGREGOR SMITH.....Florida Power & Light Co., Miami, Fla.
A. C. SPURR.....Monongahela Power Co., Fairmont, W. Va.
O. TITUS.....Metropolitan Edison Co., Reading, Pa.

(Terms Expiring 1951)

J. T. BARRON.....Public Service Electric and Gas Co., Newark, N. J.
J. M. BARRY.....Alabama Power Co., Birmingham. Ala.
GEORGE M. GADSBY.....Utah Power and Light Co., Salt Lake City, Utah
D. E. KARN.....Consumers Power Co., Jackson, Mich.
J. E. LOISEAU.....Public Service Company of Colorado, Denver, Colo.
PAUL B. MCKEE.....Pacific Power and Light Co., Portland, Ore.
C. B. MCMANUS.....Georgia Power Co., Atlanta, Ga.
S. C. MCMEEKIN.....South Carolina Electric & Gas Co., Columbia, S. C.
GROVER C. NEFF.....Wisconsin Power and Light Co., Madison, Wis.
P. H. POWERS.....West Penn Power Co., Pittsburgh, Pa.
HAROLD QUINTON.....Southern California Edison Co., Los Angeles, Cal.
J. B. THOMAS.....Texas Electric Service Co., Fort Worth, Texas
JOHN T. WARD.....Boston Edison Co., Boston, Mass.
W. F. WYMAN.....Central Maine Power Co., Augusta, Maine

(Executive Committee)

The Executive Committee consists of the following members of the Board of Directors: Messrs. J. T. Barron, W. H. Burke, E. W. Doebler, A. H. Kehoe, P. H. McCance, Chas. E. Oakes, P. H. Powers, O. Titus and J. T. Ward.

EDISON ELECTRIC INSTITUTE OFFICERS AND COMMITTEES

(Continued)

ADVISORY COMMITTEE

D. C. BARNES...Virginia Electric & Power Co., Box 431, Charlottesville, Va.

E. F. BARRETT.....Long Island Lighting Company, Mineola, N. Y.

S. R. BERTRON.....Houston Lighting & Power Co., Houston, Texas

J. B. BLACK.....Pacific Gas and Electric Co. San Francisco, Calif.

GEORGE H. BLAKE
Public Service Electric and Gas Co., Newark, N. J.

B. F. BRAHENEY.....Northern States Power Co., Minneapolis, Minn.

PRENTISS M. BROWN.....The Detroit Edison Co., Detroit, Mich.

CURTIS E. CALDER.....Electric Bond & Share Co., New York, N. Y.

J. W. CARPENTER.....Texas Power and Light Co., Dallas, Tex.

GEORGE A. DAVIS.....Oklahoma Gas and Electric Co., Oklahoma City, Okla.

SAMUEL FERGUSON....The Hartford Electric Light Co., Hartford, Conn.

J. F. FOGARTY.....The North American Co., New York, N. Y.

H. P. LIVERSIDGE.....Philadelphia Electric Co., Philadelphia, Pa.

E. J. MACHOLD.....Niagara Hudson Power Corp., Syracuse, N. Y.

T. W. MARTIN...Alabama Power Co., Birmingham, Ala.

J. WESLEY MCAFEE.....Union Electric Co. of Missouri, St. Louis, Mo.

IRWIN L. MOORE.....New England Electric System, Boston, Mass.

W. C. MULLENDORE....Southern California Edison Co., Los Angeles, Calif.

A. B. PATERSON.....New Orleans Public Service Inc., New Orleans, La.

W. H. SAMMIS.....Ohio Edison Co., Akron, Ohio

WILLIAM SCHMIDT, JR.,
Consolidated Gas Electric Light & Power Co., Baltimore, Md.

PHILIP SPORN.....American Gas & Electric Co., New York, N. Y.

L. V. SUTTON.....Carolina Power & Light Co., Raleigh, N. C.

R. H. TAPSCOTT..Consolidated Edison Co. of N. Y. Inc., New York, N. Y.

E. S. THOMPSON....The West Penn Electric Co., Inc., New York, N. Y.

J. V. TONER.....Boston Edison Co., Boston, Mass.

G. W. VAN DERZEE.....Wisconsin Electric Power Co., Milwaukee, Wis.

J. R. WHITING...The Commonwealth & Southern Corp., New York, N. Y.

E. A. YATES....The Southern Company, New York, N. Y.

CHAIRMEN OF EDISON ELECTRIC INSTITUTE COMMITTEES (1948-1949)

ACCOUNTING

Accounting Division Executive, ALLAN G. MITCHELL.....Philadelphia Electric Co., Philadelphia, Pa.
Application of Accounting Principles, H. H. SCAFF.....Ebasco Services Inc., New York, N. Y.
Customer Activities, R. G. SCHNEIDER.....Virginia Electric & Power Co., Richmond, Va.
Depreciation Accounting, ARTHUR H. KUHN.....Pioneer Service & Engineering Co., Chicago, Ill.
General Accounting, E. L. CASSADY.....Indianapolis Power & Light Co., Indianapolis, Ind.
Plant Accounting and Records, J. A. RYAN.....Consolidated Edison Co. of New York, Inc., New York, N. Y.
Taxation Accounting, J. R. WEGER.....Consolidated Gas Electric Light & Power Co., Baltimore, Md.

COMMERCIAL

Commercial Division General, HARRY RESTOFSKI.....West Penn Power Co., Pittsburgh, Pa.
Commercial Sales Section, C. A. STEVENS.....Public Service Electric & Gas Co., Newark, N. J.
Farm Section, J. C. CAHILL.....The Detroit Edison Co., Detroit, Mich.
Industrial Power and Heating Section, J. R. HARTMAN.....The Cincinnati Gas & Electric Co., Cincinnati, Ohio
Residential Section, H. A. STROUD.....Monongahela Power Co., Fairmont, W. Va.
Sales Personnel and Training, E. O. GEORGE.....The Detroit Edison Co., Detroit, Mich.
Wiring and Specifications, F. E. DAVIS.....The Commonwealth & Southern Corp., Jackson, Mich.

ENGINEERING

Engineering Division General, E. W. DILLARD.....New England Power Service Co., Boston, Mass.
Electrical Equipment, B. VAN NESS, JR.....Pennsylvania Water & Power Co., Baltimore, Md.
Hydraulic Power, G. R. STRANDBERG.....Stone & Webster Engineering Corp., Boston, Mass.
Meter and Service, H. M. JOHNSON.....New England Power Service Co., Boston, Mass.
Prime Movers, G. C. DANIELS.....The Commonwealth & Southern Corp., Jackson, Mich.
Transmission and Distribution, T. J. BROSNAN.....Buffalo Niagara Electric Corp., Buffalo, N. Y.

GENERAL

Accident Prevention, E. J. KREH.....Duquesne Light Co., Pittsburgh, Pa.
Industrial Relations, C. B. BOULET.....Wisconsin Public Service Corp., Milwaukee, Wis.
Insurance, I. M. CARPENTER.....Ebasco Services Inc., New York, N. Y.
Membership, J. F. FOGARTY.....The North American Co., New York, N. Y.
Prize Awards, H. M. SAWYER.....American Gas & Electric Service Corp., New York, N. Y.
Purchasing and Stores, R. W. T. PURCHAS.....Middle West Service Co., Chicago, Ill.
Rate Research, S. W. ANDREWS.....American Gas & Electric Service Corp., New York, N. Y.
Statistical, O. E. SMITH.....Consolidated Gas Electric Light & Power Co., Baltimore, Md.
Transportation, LINN EDSALL.....Philadelphia Electric Co., Philadelphia, Pa.
Codes and Standards (a Subcommittee of the Board of Directors), A. H. KEHOE, Consolidated Edison Co. of New York, Inc., New York, N. Y.